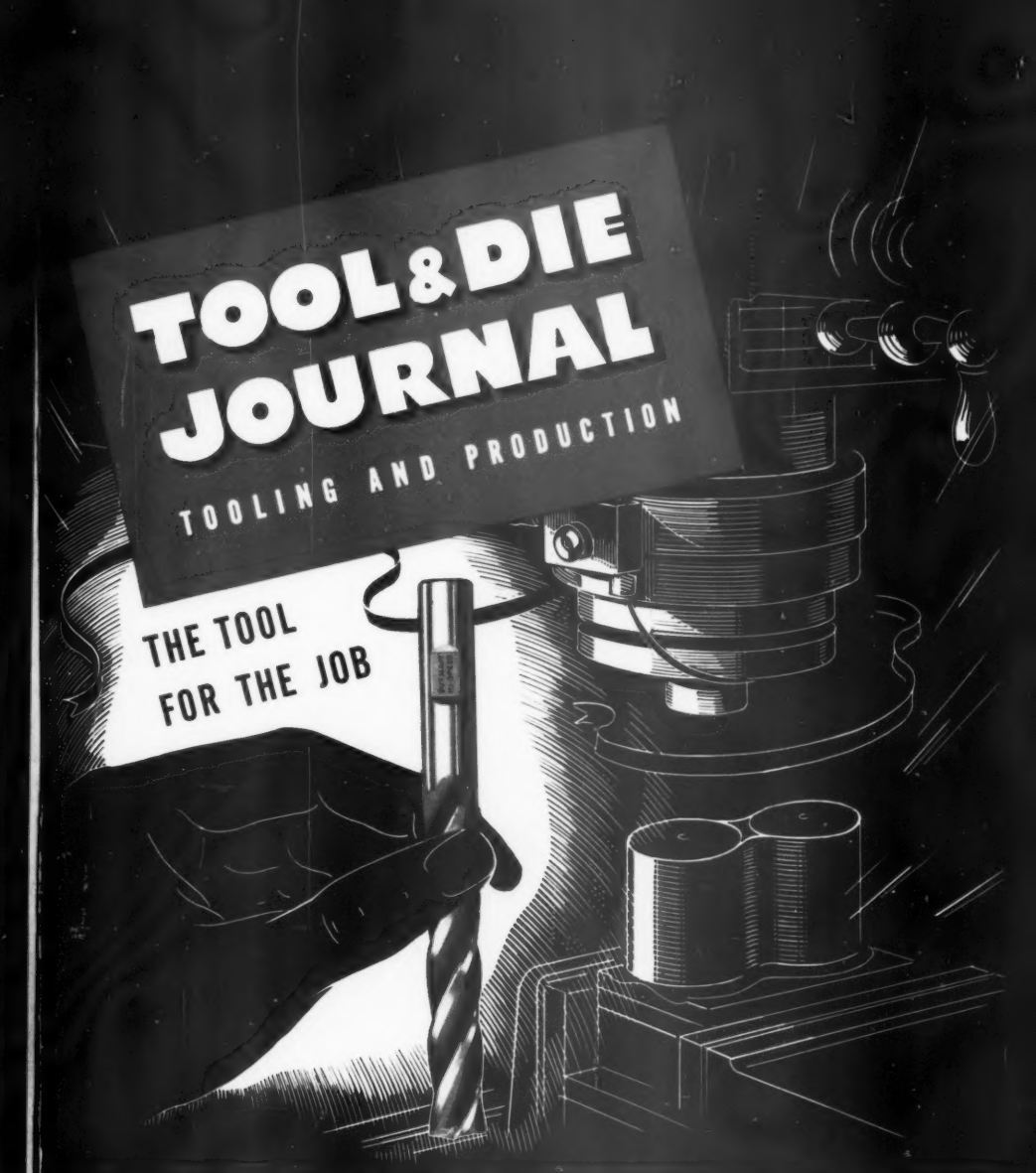

PUTNAM END MILLS FOR FINISH MILLING

END MILLS AVAILABLE FROM STOCK

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ARMY NAVY

AWARDED AUGUST 15, 1942

Exceptional finish from the milling operation alone can be obtained by using Putnam Hi-Speed End Mills. These tools are of a design and quality that make them especially adaptable to operations involving high spindle speeds, precision movements, rotary head motion, or other difficult conditions. No matter what kind of a milling job you have, a Putnam Hi-Speed End Mill is always "the tool for the job."

PUTNAM TOOL COMPANY

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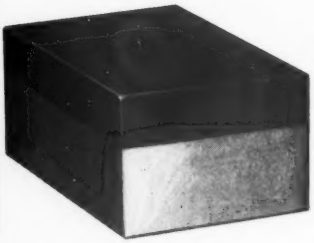

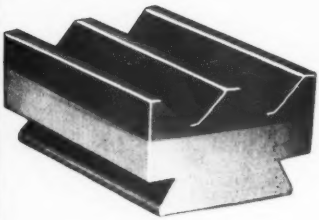

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5. *Marked saving of strategically important tungsten.*

QUALITY FCC SERVICE

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Hardinge developed the use of two levers to operate electrical switches for changing precision lathe spindle speeds.

As illustrated, each lever has two speed positions only. The operation of each lever to a speed position is to a definite location. This means *convenience and speed* as the operator can concentrate his attention on the work. Concentration on work results in greater production and better workmanship.

Consideration of every detail characterizes HARDINGE machine design.

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"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

THE TOOL & DIE JOURNAL

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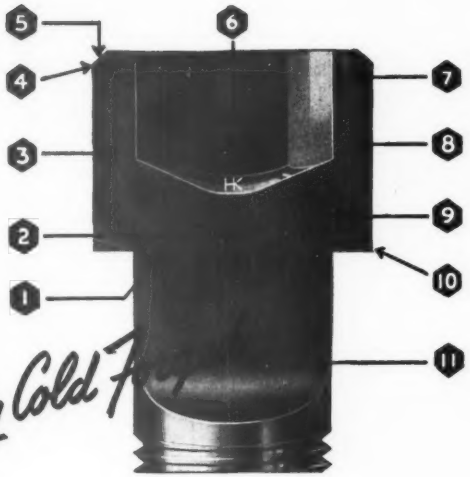

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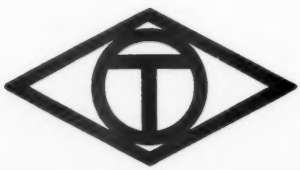
ON six continents and on the seven seas can be found bullets that drive back the enemy—bullets made by the tools *we make.*

Continuous expansion of our facilities in the specialization of the manufacture of small arms ammunition tools and gages on a quantity production basis is our reply to the Axis. All-out production for all-out war *must* continue.

When both war and peace have been won, our increased equipment and trained personnel will enable us to meet, more adequately than ever, the needs of peacetime pursuits.



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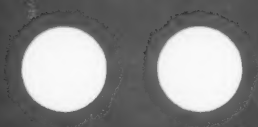
Embodying features not to be found in any other one machine will be announced soon...



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Sav-way INDUSTRIES

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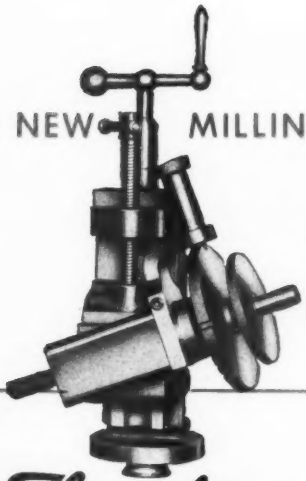

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Set this time saver up on any bench lathe — slip on a stock index plate — and the most inexperienced operator can produce indexed work with no chance for error through miscalculation.

The 3-way swing provides exceptional maneuverability, so that it readily produces a wide variety of end mills, special cutters, reamers, splines and punches. Plain milling of flat stock may also be accomplished by using the sturdy vise without indexing unit.

Awarded to AUTO-ORDNANCE CORPORATION for excellence in production of "Tommy Guns."

Index Fixture tilted at 30° milling end teeth in Taper Reamer.

Fixture and Base at right angles milling straight teeth in cutter.

Base of Fixture on 30° angle milling end teeth in cutter.

End Mill operation showing work extended thru fixture.

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AUTO-ORDNANCE Corporation
THOMPSON TOOL DIVISION
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ROTOREX UNIVERSAL TOOL AND CUTTER GRINDER

ONE machine for all Tool Grinding.

Cylindrical, Internal, Radius, Tap Grinding.

Every attachment readily interchangeable.

Quick delivery through increased production.

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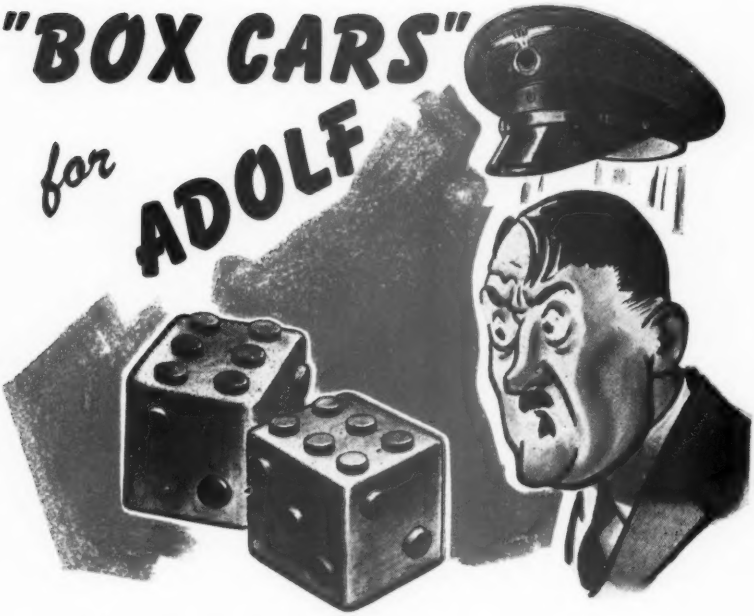
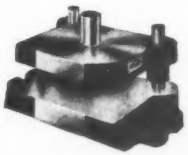


That odd name came from the shop where strange cubical structures are daily welded and machined. It is known that they are war material, destined to go on to other American workers who will fit them into structures for the defense of America and the defeat of the Axis.

Along with them, and huge weldments for the Navy, move die sets from the size of your hand to the huge six ton slabs of metal that stamp out airplane wings, tank sides, portable air fields; and we know not what, for the defense of America and the defeat of the Axis.

DANLY  DIE SETS

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Solves Tough Jobs Like These....

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GORTON ANNOUNCES a new, more versatile Precision Automatic —the Model 16-A Screw Machine. Built to meet America's emergency and post-war critical needs for mass production of extremely small, intricate parts. Long, slender pieces—multiple diameters are finely finished to closer tolerances, in one operation. Unique design offers almost limitless scope in generating any shapes. Present deliveries, 6 to 8 weeks.

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Gorton 16-A retains all the famous features of the Petermann P-7, with complete re-engineering by Gorton, adding further improvements and refinements.

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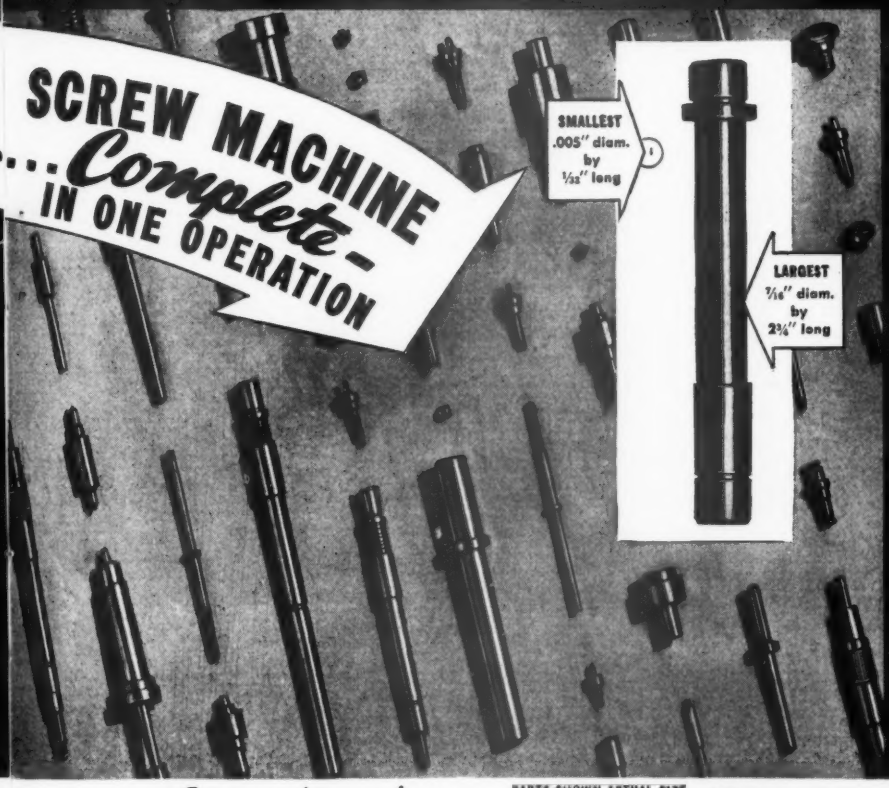

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ACCURACY AND QUALITY OF FINISH
High diametrical accuracy—work rigidly supported at point of cutting tool load. Unusually high finish—grinding often eliminated.

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Maximum accessibility for quick set-ups. Uses only standard single point tool bits. Micrometer adjustments on every tool. Centralized controls—infinitely variable speeds and cam feeds at touch of dials.

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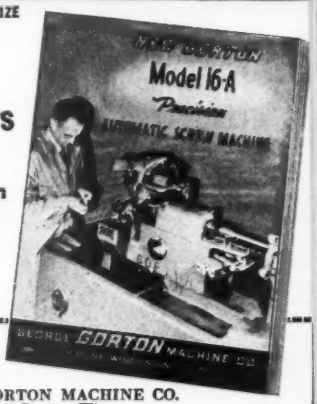

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Send me immediately, complete information with FREE bulletin of specifications and data covering the new Gorton Model 16-A Precision Automatic Screw Machine. No obligation, of course.

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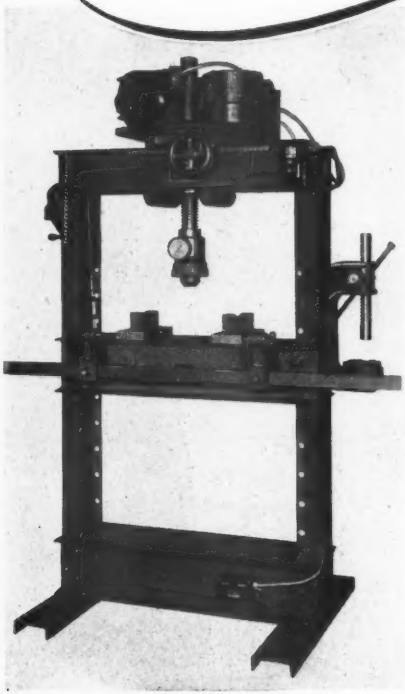
a press, a part and a poke at the Axis . . .

AUTOMATIC PRESSURE CONTROL GAUGE



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POWER PRESSES

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ACHIEVE 6 PRACTICAL ADVANTAGES BY 1 TRIMMING OPERATION

1. Perfectly flat, straight edges.
2. All shells of absolutely uniform depth.
3. All shells without fins or burrs.
4. A perfectly smooth outside surface at trimming line.
5. Lower trimming cost.
6. Lower tool cost per part because all dies can be used for trimming a multiple of shells.

Each of the parts illustrated on this page was completely TRIMMED IN ONE OPERATION on a Brehm Trimming Die. The photographs show exactly what you may expect from Brehm Trimming as applied to your problem.

To learn what Brehm Trimming Dies will do for you, send sample shells or part prints.

THE STEEL PRODUCTS ENGINEERING COMPANY
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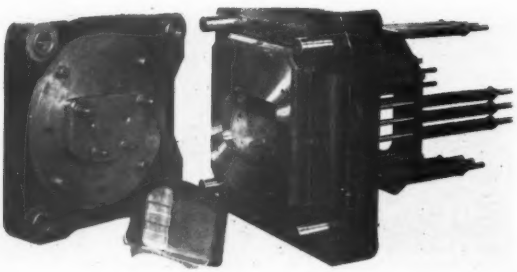
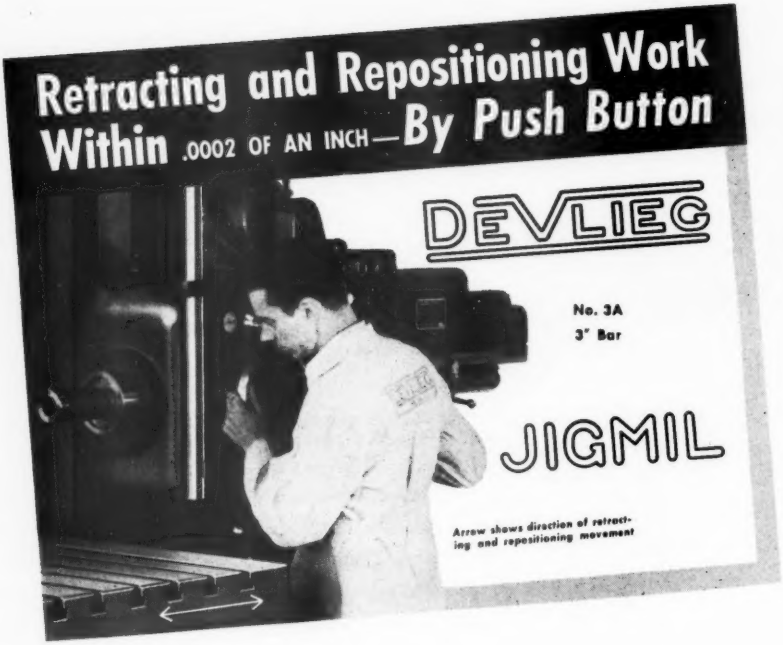
BREHM (THE "SHIMMY" DIE) TRIMMING DIES



Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button



The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

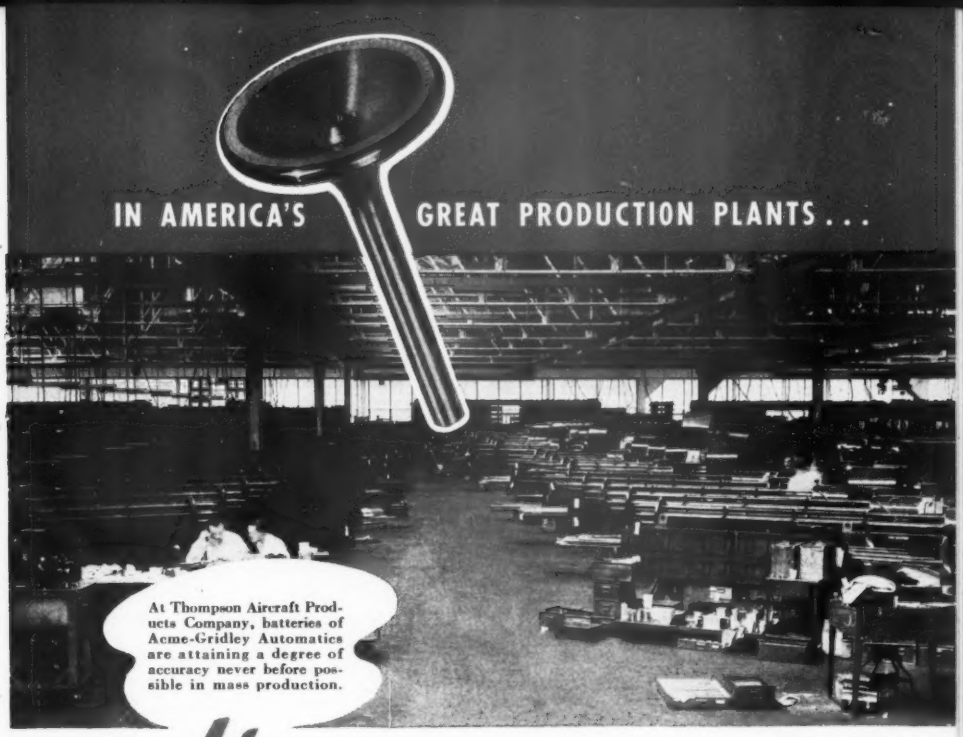
The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular
DEVLIEG MACHINE TOOLS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At Thompson Aircraft Products Company, batteries of Acme-Gridley Automatics are attaining a degree of accuracy never before possible in mass production.

Millions of Parts—QUICK!

Two and three times faster than they have ever been produced before, metal parts in great variety, machined with the utmost precision—those are the demands of a war production greater than any nation has ever met!

Acme-Gridley Automatics are turning out these parts, at speeds and feeds limited only by the capacity of tools to stand up under 24-hour schedules.

These 4, 6 and 8-spindle machines are quickly adapted to many classes of work, often as many as 20 operations on a single set-up. Large tooling area speeds setting up. Operation is convenient, output is uniform, costs are low.

And when industry goes to work on the growing backlog of peace-time needs, Acme-Gridleys will be ready to carry their full share of the load—at lower costs than ever before.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

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FIRTHITE

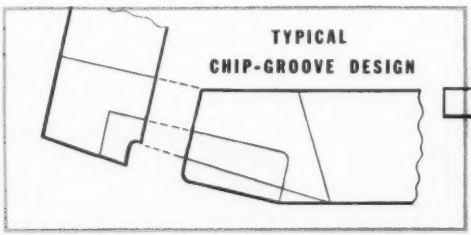
CHIP CONTROL

The rapid machining of **alloy steel** requires effective means of controlling chips. Long, hot, tough chips endanger the operator, make chip disposal difficult, reduce the value of scrap (by $2.00 a ton), cause tool breakage, and delay work.

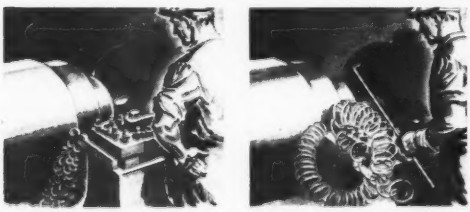
The remedy is properly designed chip breakers. Tools with chip breakers require a little more power but, where long chips are a problem, chip breakers are the answer.

Aside from the safety factor, chips that can be **shovelled** are readily marketable as scrap, command a higher sale price per ton, and—most important to the war effort—speed the **recovery** of scarce and critical alloys.

HOW TO GRIND A CHIP BREAKER EASILY, QUICKLY, INEXPENSIVELY



A quick, simple method of designing and grinding chip breakers, as illustrated, is described on pages 41 to 43 of the FIRTHITE Users' Handbook . . . or, a FIRTHITE Engineer will gladly discuss chip control in your plant.



CHIP CONTROL WITH CHIP BREAKER VS. NO CONTROL WITHOUT CHIP BREAKER

Firth-Sterling
STEEL COMPANY
MAKERS OF FIRTHITE TUNGSTEN-TITANIUM CARBIDES FOR STEEL CUTTING

SHOWS HOW

TO BREAK UP YOUR ALLOY-STEEL CHIPS

AUTOMATICALLY...

FOR SAFETY AND PROFIT

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STEEL COMPANY

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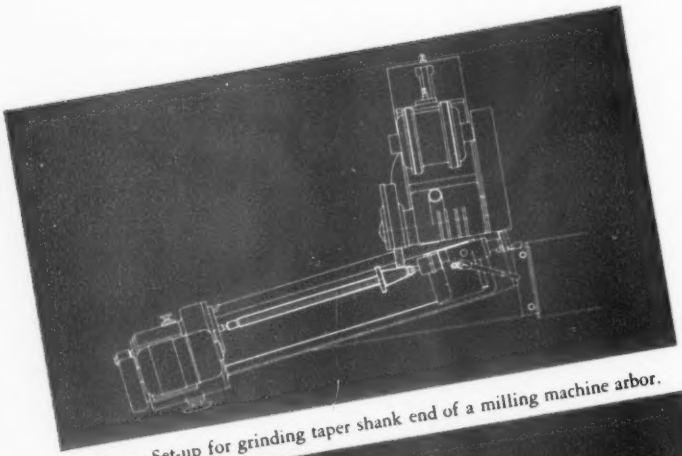
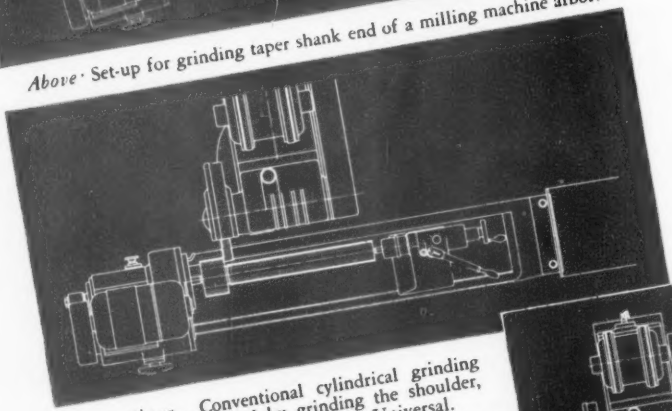
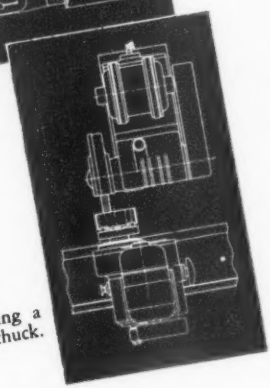
WIDE VARIETY



Above· Set-up for grinding taper shank end of a milling machine arbor.



Above. Conventional cylindrical grinding set-up, followed by grinding the shoulder, on a CINCINNATI Hydraulic Universal.



Right: Rotary surface grinding a part held in the standard chuck.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

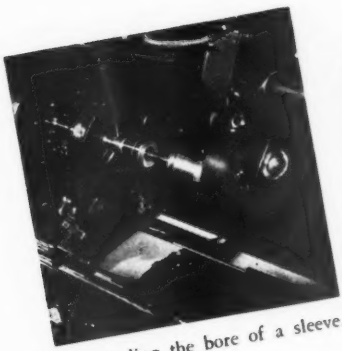
TOOL ROOM AND MANUFACTURING MILLING MACHINES . . SURFACE BROACHING MACHINES . . CUTTER SHARPENING

OF PRECISION WORK
Quickly Set Up and Finished
on CINCINNATI *Hydraulic Universal Grinders*

● Of the many factors to consider in the selection of a universal grinder, these two should receive first consideration: (1) how large a variety of work will the machine handle, (2) how fast can the work be accurately finished, including set-up time. An indication of the way in which CINCINNATI Hydraulic Universal Grinding Machines fulfill these requirements has been presented in the small illustrations on these two pages.

First of all, the CINCINNATI machine readily handles three basic types of precision tool-room grinding; cylindrical, internal, and rotary surface. Of course, many variations of these three classifications of work, such as steep tapers, may also be ground on the CINCINNATI. The second factor, set-up time, is exceptionally low for all types of work. For example, the internal grinding attachment may be set to grinding position by merely swinging it down and tightening one bolt.

All these features and many more are presented in catalogs which may be obtained on request: No. G-486 for the 12″ machine and G-474-1 for the 14″, 16″, and 18″ machines.



● Grinding the bore of a sleeve.

● CINCINNATI 12″ x 24″ Hydraulic Universal Grinding Machine.

CINCINNATI GRINDERS INCORPORATED CINCINNATI, OHIO, U.S.A.
MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

Designing and Building
Tools, Dies, Special Machines and Parts

The illustration shows a section of our Engineering Department in which special tools, jigs, fixtures and special machines are designed for unusually wide diversification of industries.

A shop that is equipped—as we are—to see a job through from drawing to finished part, assembly or machine—is, like an individual, skilled, conscientious craftsman, able to get the job done most efficiently.

From our Engineering Department to our final inspection, our facilities in equipment and manpower have been built to render exacting precision service.

For years we have kept modernizing our equipment systematically.* We are able to meet many unusual demands that are now being made on contract shops.

**Send for circular listing our shop machines.*

THE BUNELL MACHINE & TOOL COMPANY
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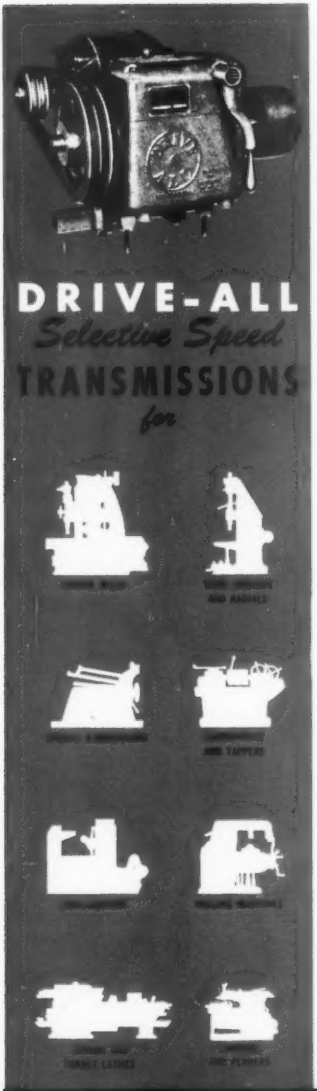

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MACHINE TOOL TRANSMISSIONS

Quickly Available to Industry

- ★ Fingertip Control
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POSITIVE accuracy with versatility and adaptability are combined in a Norton 6" x 18" Hydraulic Surface Grinder.

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Investigate the Norton 6" Surface Grinder. Norton representatives and engineers are ready to give you every possible assistance in solving your grinding problems.

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NORTON GRINDERS

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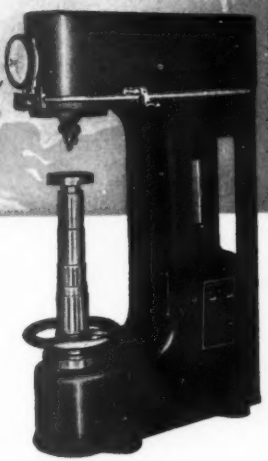
CLARK HARDNESS TESTER

For "Rockwell Testing"



A precision built instrument for testing the hardness of hardened and soft steel, non-ferrous metals, and metal alloys, by penetration; calibrated on the major load of 150 Kg. which consists of three calibrated weights (60 Kg, 40 Kg, and 50 Kg) and on the minor load of 10 Kg, thus being able to make either direct or conversion hardness readings.

INCLUDED WITH EACH INSTRUMENT:

Diamond Penetrator	**Checking Anvil**
1/16" Ball Penetrator	**3½" Anvil**
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Leather Cover for Instrument
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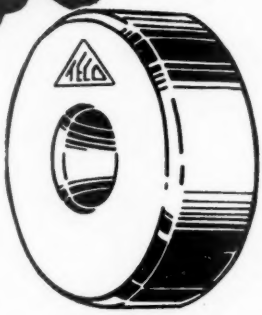
"Here's the Die THAT WILL INCREASE YOUR CARTRIDGE CASE PRODUCTION!"

From first draw to finish—through drawing, sizing, tapering, necking and swaging—TECO Carbide Dies are speeding-up the production of smoothly-finished, on-size cartridge cases in leading ordnance plants.



Equipped with TECO Carbide Dies, your machines operate at higher speeds for longer runs. Rejects are eliminated. Down-time is reduced. Capacity production is attained. Responsible for this outstanding performance are the rigid standards of uniformity, density and hardness to which TECO Carbides are held through every step in fabrication. A test run tells the story most convincingly. Discuss your needs with our engineers.

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TECO *Pioneers in Tungsten Carbides for over a Quarter Century* TECO **CARBIDE DIES**

GAGES *for Delivery* TODAY!

AS a service to industry, this company maintains a substantial inventory of standard gages in a wide variety of types and sizes, from which immediate deliveries can be made.

Because demands on this stock are variable, we cannot always guarantee to ship at once, every size and type, but you may always be sure of getting prompt shipment of most standard gages.

Standard Thread, Plug and Ring Gages in sizes No. 5 to 1½", as well as minor diameter plain plugs, are carried in stock. Other sizes and types made on special order.

Remember that all gages bearing the PM Diamond Emblem are of extreme accuracy and careful finish. The emblem is your guarantee that these gages provide safe and sure production controls of dimensions for precision and manufacture.

We suggest frequent reference to your Pipe Machinery Gage and Small Tool Manual. You will find it a big help in these days of tight production schedules. If you do not have a copy, we'll gladly send you one on request.

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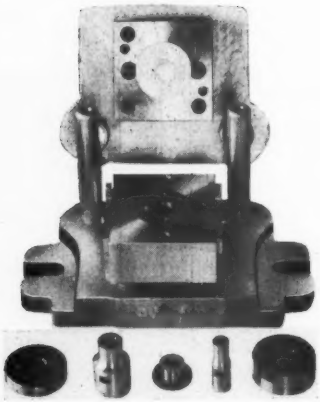

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5 REASONS WHY
YOU WILL SAVE
MATERIALS AND
MONEY BY MAKING
WASHERS
"THE HOVIS WAY"

Made in
4 sizes:
¾", 1½",
2½", 4"

1. **HOVIS MASTER DIES** using interchangeable parts make any number of different washers, thus eliminating special washer dies.
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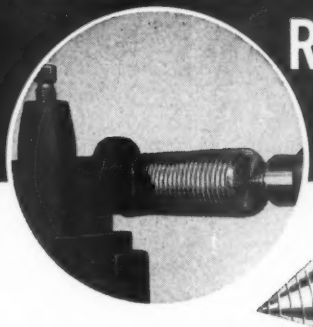
WRITE FOR ILLUSTRATED FOLDER

1500% LONGER RUNNING TIME

BEFORE CENTER POINT NEEDS ATTENTION



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Helical Groove CENTERS

When Used With

CMD CENTER POINT

LUBRICANT

have an operating ratio of from 15 to 1 running time over the conventional type of lathe center.

● A BETTER CENTER:

The grooves hold an ample supply of lubricant for replenishing the lubricant that is dissipated because of heat.

Because the grooves are left-hand (in the same direction as the turn of the work) they prevent dripping and force lubricant to extreme point of center assuring proper lubrication of entire bearing surface. No production delays to replace galled or burned-out centers!

● A BETTER LUBRICANT:

CMD Center Point Oil withstands pressures greater than 50,000 lbs. per square inch. The center can be drawn up tight against the work permitting finer tolerances.

Write for FREE *Sample Kit*

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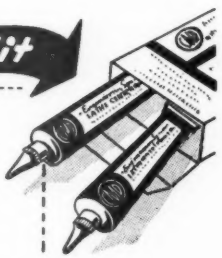
☐ Send circular on CMD Helical Groove Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT LUBRICANT and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....
FIRM NAME .....
ADDRESS .....



Multi-angle MILLING with the VERNON Vertical Milling Head

Power—Precision—Flexibility with 4 Cutting Speeds: 280, 525, 933 and 1750 R.P.M. Higher speeds optional.

Quick set-ups on workpiece—head rotates 360° in longitudinal plane. Belt guard swivels to any position.

Write for our folder giving complete information.

No need to remove work for angular milling. Head can be swiveled 25° each side of vertical in transverse plane.

Note that the unit is reversible on the overarm for most convenient positioning (compare with opposite photo). All movements readily duplicated by graduated scales.

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST. VERNON LOS ANGELES CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

Welch

QUICK DEMAGNETIZER

Operates on **220 VOLTAGE** A. C. 60 Cycle

EFFICIENT, POWERFUL . . . Needed Wherever Magnetic Chucks are Used

INSIDE MEASUREMENTS APPROXIMATELY 4" x 11"

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ANOTHER WELCH PRODUCT

YOU are assured satisfaction and a substantial saving of time when you use the Welch Quick Demagnetizer. Operating on 220 voltage, any ordinary sized pieces, such as cutters, gears, washers, etc., can be demagnetized by ONLY A SINGLE PASS THROUGH ITS POWERFUL FIELD. Your own electrician can easily connect it in any handy location in your plant. It is equipped with a convenient switch. (When ordering, kindly inform us if your power is other than 220 volt, 60 cycle, A. C.) Carried in stock . . . Immediate Delivery. 10 DAYS FREE TRIAL IF DESIRED.

Price $120

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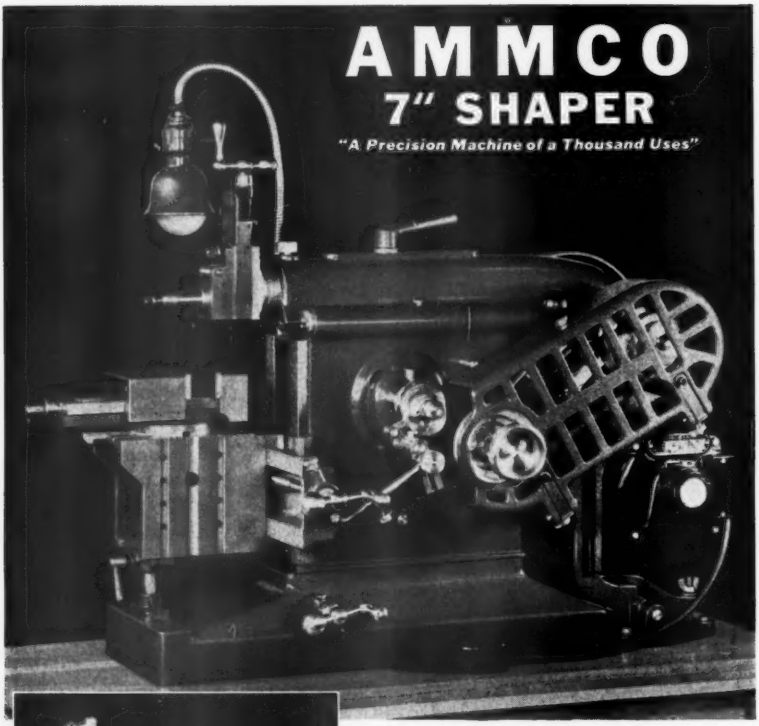
Welch INDUSTRIES, INCORPORATED

Makers of High Speed Milling Cutters — Form Tools and Special Tools

20000 WEST EIGHT MILE RD. DETROIT, MICHIGAN



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just pull up to bench -- plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

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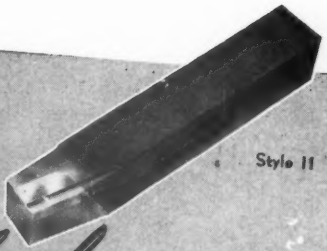
Write today for specifications and prices

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2122 Commonwealth Avenue **North Chicago, Ill.**

CUTTING HIGH BRINELL STEEL *Calls for* KENNAMETAL*



Turning Hadfield Manganese Steel with Kennametal Tool Style 11

One of the greatest problems in the machining of metal has been the cutting of hard steels. In the past, output of highly accurate parts in this field has been hindered by the lack of an efficient tool composition. The discovery of an intermetallic compound, tungsten-titanium carbide, has provided the answer to the problem of machining steels of high tensile strength.

KENNAMETAL tools, made from this basic ingredient with binders of carburized tungsten and cobalt, and cemented in vacuum electric furnaces, have the requisite strength and hardness for the general machining of steels in a wide range of hardness up to 550 Brinell.

If your problems involve machining steels of high tensile strength, use KENNAMETAL—the tool of faster, greater production.

KENNAMETAL THE All American CARBIDE

*INVENTED AND MANUFACTURED IN U. S. A.

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Get the McKINNEY PLUS+ FACTOR

+ in Tools · Jigs · Fixtures

Two tools, almost identical in appearance, may give vastly different results in actual service.

Both turn out parts but one produces *more accurate* work —in *larger quantities*—at *lower cost* and for a *longer period of time* before requiring attention.

The element of more satisfactory performance in the superior tool is generally due to the broad, practical experience of its producer—A PLUS FACTOR, as compared to ordinary tools, which manufacturers have a right to demand.

Today, when plants mushroom into being and new, comparatively unknown organizations seek contracts involving great responsibility, it behooves those placing business to protect their interests by careful investigation.

We welcome such investigation and "will stand or fall" in our efforts to get business—upon past accomplishments.

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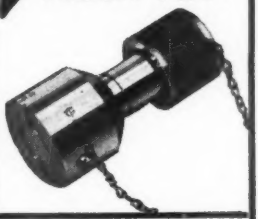
DESIGN and PRODUCTION ENGINEERS Since 1920

Tools · Dies · Jigs · Fixtures · Special Machinery

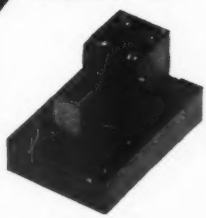
✔ RING

✔ SNAP

✔ FLUSH PIN



✔ BUILD UP



FAST DELIVERY

on these TURNER gauges

✔ RING ✔ FLUSH PIN
✔ SNAP ✔ BUILD UP

EACH TURNER GAUGE BEARS THEIR STAMP OF PRECISION

Again Turner scores a first on the production front—with this announcement on fast delivery of their precision built gauges. These Ring, Snap, Flush Pin and Build Up gauges all bear the Turner Stamp of Precision—your guarantee that they have been carefully inspected and approved according to Turner's high standard of gauge making.

Our new plant is the reason why we can still maintain the highest standards, while increasing our production. It houses the most modern equipment available, and the most experienced men to run it.

Let us fill that rush gauge order. Wire or write us today.

Wire or Write Your Order Today!

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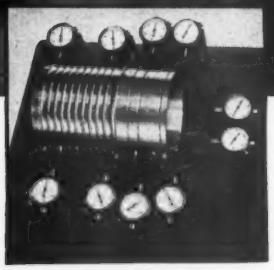
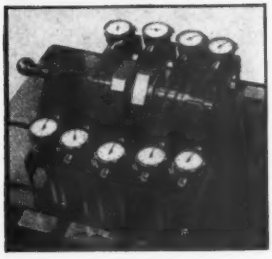
10 Dimensions inspected simultaneously





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One-at-a-time inspection of dimensions is only single-shot rifle shooting. The men at the fighting front use faster methods, but how about you on the home front?

These gages show how nine and ten dimensions can be inspected in a fraction of the former time — *more positively* — and *more accurately*. Investigate this fast, accurate and low cost method of inspection. Write to:

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CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
★ Operation Saving
★ Material Saving
Fine Finish
★ Flatness
★ Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"

Semi-Steel
Stock per side ⅛"
Limits ±.005"
square .001"
to .0015" in 16"

No. Sides 6
1 piece (6 surfaces)
1 hour and 35 min.

THE SHAPER TABLE, 15½" x 16" x 16", illustrated here, is an excellent example of large, heavy work which may be ground with ease on a Blanchard No. 18 Surface Grinder with 6-inch extended column. These tables come to the Blanchard as rough, semi-steel castings. Six sides are ground, ⅛" stock being taken off each side.

The BLANCHARD
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64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Speed WAR PRODUCTION TRAINING

USE THESE BOOKS AND FILMS ON LATHE OPERATION

One of the most serious problems confronting management today is the training of new employees to replace thousands of skilled technicians who have been called for service with the armed forces. With inexperienced workers, production goals must be increased and standards of precision and quality must be maintained. To accomplish this, a vast army of unskilled men and women must acquire new skills in the shortest possible time.

To help you train new lathe operators, we offer the practical aids listed below. These books and films on lathe operation have proved effective in hundreds of apprentice training schools, including Army and Navy training stations. Sample copies of literature free to apprentice supervisors.

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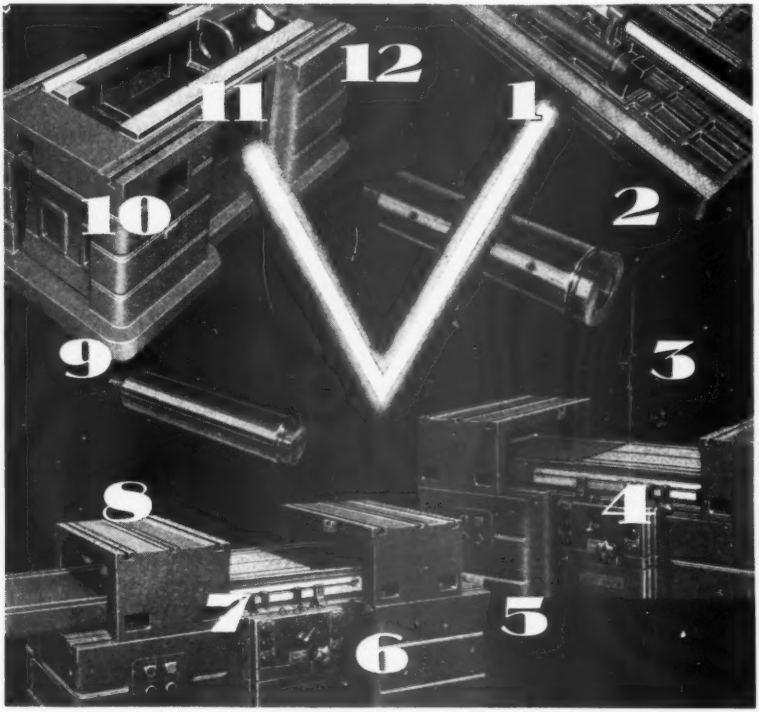
SOUTH BEND LATHE WORKS
LATHE BUILDERS FOR 26 YEARS — SOUTH BEND, INDIANA

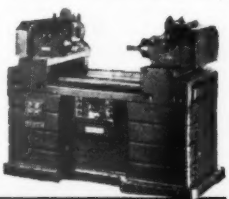


BUILT FOR 24-HOUR SERVICE!

The Ex-Cell-O Precision Boring Machine is designed and built to "take it", every hour of the day, every day of the week. Moving parts, such as spindles, drive units, braking equipment, are located on bridges above the work table. These bridges, coupled with heavy base and reinforced table, provide a precision machine that is exceptionally solid and firm. Boring units are easily accessible so that adjustments and changes are a simple matter for the operator. The Ex-Cell-O name on a precision boring machine means not only a precision-built machine to do precision work, but a machine tool that gives the utmost in efficiency with a minimum in maintenance attention.

EX-CELL-O CORPORATION • DETROIT

Below: No. 215-A—one of nine different styles of Ex-Cell-O Precision Boring Machines . . . for boring, turning, facing.



XLO

EX-CELL-O means PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

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TOOL STEEL *ELECTRODES* SAVE

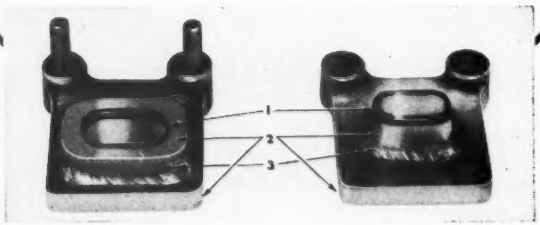
tons of vital TOOL STEEL

Every day, tons of critical tool and die steels are being saved for vital war needs by the use of EUREKA Electrodes for the welding of worn or fractured dies. These EUREKA Electrodes can be used to effect maintenance repairs in *your* shop on oil, air and water hardening and hot working steels.

EUREKA Electrodes also save a vast amount of tool and die steels when used for the composite construction of dies, by welding on the working edges of *less* expensive and easily procurable carbon steels.

If you really want to save tool and die steels in the construction or repair of your dies it will pay you to write for our 16-page catalogue today. It describes in detail the use of the complete line of EUREKA Tool Steel Electrodes.

HERE IS HOW IT HELPS THE WAR EFFORT



★ Illustration shows typical fabricated dies. Arrows 1 point out tool steel electrode deposits used as cutting edges, neither of which are over $\frac{3}{16}$ inch thick. Arrows 2 indicate machine steel used instead of tool steel to lower die composition cost, and 3 refers to construction welds made of mild steel rod to hold die parts together.

★ *Write for information on "SUTTONIZING" our welding process for the reclamation of high speed steel cutting tools.* ★

WELDING EQUIPMENT & SUPPLY CO.

226 LEIB STREET • DETROIT, MICHIGAN

75% of standard MALE THREAD GAGES can be DELIVERED in 48 hours!

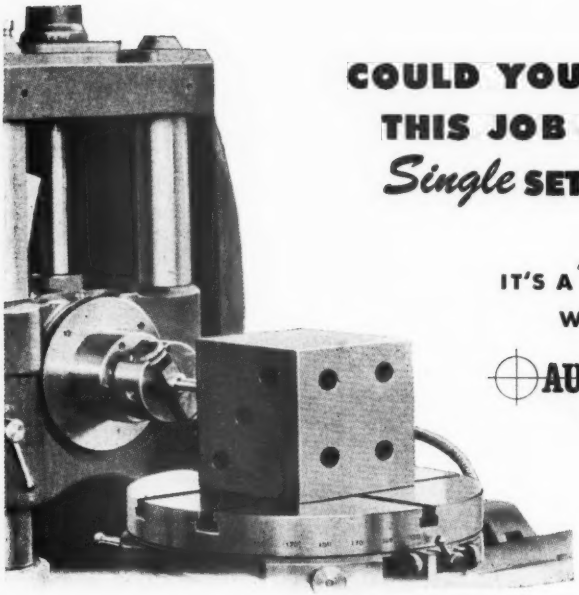
★ With the tremendous response to our advertisement last month announcing the "48-Hour Delivery" on 75 per cent of standard male thread gages, we are convinced that many manufacturers throughout the country need this type of gage. That is the reason why we repeat this offer of 48-hour delivery service.

A combination of a new plant, modern equipment and experienced workmen has made it possible for Perfex to make this offer. Yes, it is the "know how" that enables Perfex to make and keep delivery promises and it is the "know how" that enables Perfex to manufacture the finest and most accurate gages. There is a 3 to 5 week delivery promise on all other Perfex standard size gages. For a prompt quotation on our standard male thread or other standard size gages send specifications and blue prints today and we will see that a quotation is immediately forwarded to you.

ACCURACY
PERFEX
OUR CREED

PERFEX manufactures Thread, Plug, Radius, Contour, Profile, Flush Pin, Adjustable Snap, Solid Snap, etc.

PERFEX GAGE and TOOL CO.
3604 GAYLORD DETROIT, MICHIGAN



COULD YOU BORE THIS JOB IN A *Single* SET-UP?

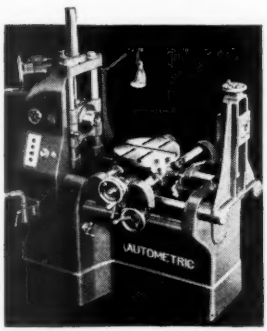
IT'S A *"Natural"* WITH THE

AUTOMETRIC

MODEL B

The illustration shows a typical time-saving operation on the Autometric Model B. All of the holes in all four sides or at various angles in a box jig or production part are produced with one clamping of the work piece.

Its ability to handle a complete job in a single set-up — more rapidly and accurately than ever before — makes the Autometric Model B indispensable equipment for the precision boring of a wide variety of parts.



Model B Autometric Features:

- Errorless measuring — more rapidly, more accurately — by the Autometric method.
- Infinite variation of spindle speeds by finger tip control.
- Infinite selection of feeds by finger tip control.
- Hardened — ground — and super finished steel ways.

Write for complete information on the Model B Autometric Jig-Boring Machine.

Buy Victory...
WITH AT LEAST 10% IN WAR BONDS

Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

RIVETT

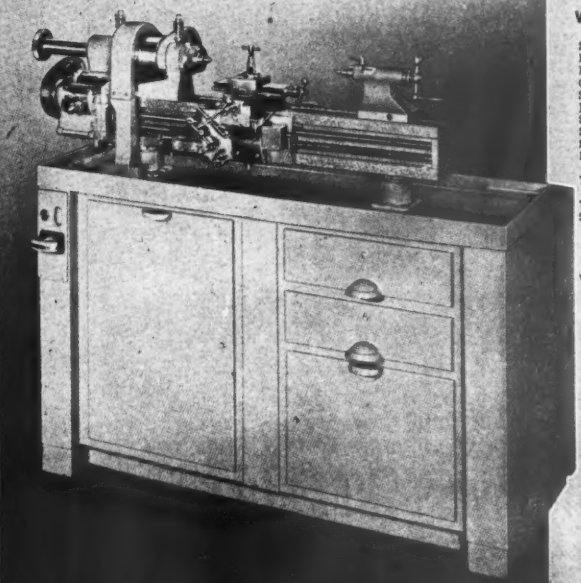
608 WITH VEE BELT DRIVE

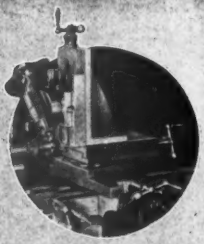
In Tool-Making and Instrument Shops It Will Handle Great Variety of Jobs in Minimum Time

The Rivett No. 608 is a super-precision, back-geared screw-cutting bench lathe designed for fine manufacturing, repair and experimental work. In tool-making and instrument shops it will handle a great variety of jobs with the greatest precision limits.

Finely made attachments for [illegible] slotting, relieving, taper turning, [illegible] and multiple operations make the best of a fully equipped No. 608 to finish his work completely without recourse to other machines, and throughout his entire series of operations to utilize the inherent precision of the lathe itself.

ARMY E NAVY





Milling

Multiple Operations

608 GEARED BENCH LATHE

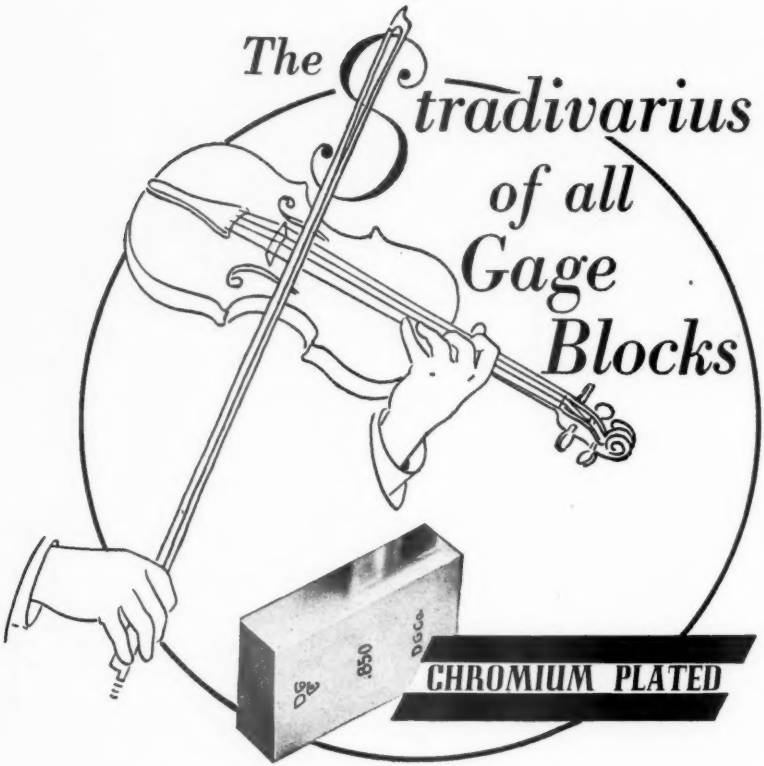
SPECIFICATIONS

With Flat or Vee Belt Drive

Swing over bed, dia.	8½"
Length of bed	40"
Distance between centers	18¼"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1¼"
Slide rest, travel of top slide	5¼"
Slide rest, travel of cross slide	4¼"
Feed range, through gear box	.0015" to .0230"
Thread range, through gear box	10 to 144
Tailstock spindle travel	3¼"
Spindle speeds:	
Flat belt drive—12 speeds	39 to 1295 r.p.m.
Vee belt drive—12 speeds	25 to 1500 r.p.m.
Weight of lathe, mounting and drive:	
Flat belt drive, net	900 lbs.
Vee belt drive, net	1050 lbs.

For Further Description Write for Bulletin 608

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

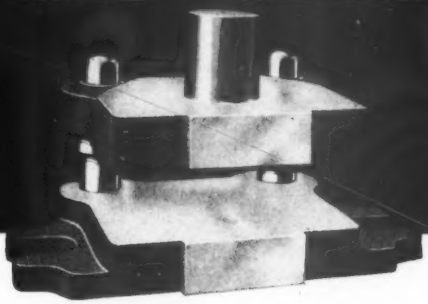


DEARBORN GAGE COMPANY

Originators of Chromium Plated Gage Blocks

22034 BEECH STREET · · DEARBORN, MICHIGAN

PRODUCTO
DIE SETS



Tool & Die Shops and Factories producing Dies and Stampings for war material can make use of and depend upon service on Producto Die Sets and Die Makers' Accessories.

These essential tools and supplies are available for shipment from our factories in Bridgeport and Detroit (addresses below). Users in Northeastern Ohio and Western Pennsylvania can secure service from Die Supply Company, 4747 Hough Avenue, Cleveland, Ohio. Pacific Coast users can obtain Die Sets and Accessories from Jamison Steel Corporation, 508 Fourth Street, San Francisco, California, and 2168 E. Olympic Boulevard, Los Angeles, California.

Use Producto Accessories—Dowel Pins, Die Springs, Stripper Bolts, etc.

Producto Modern Machine Vises for milling and drilling.

Ask for circular.

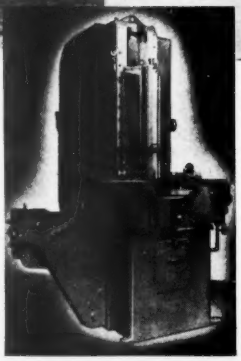
THE PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVE., BRIDGEPORT, CONN.

3017 MEDBURY DETROIT, MICH.

LINES BEHIND THE LINES

FROM PRODUCTION LINES TO FIRING LINES, IN WAR AS IN PEACE, THE AUTOMOTIVE INDUSTRY DELIVERS THE GOODS

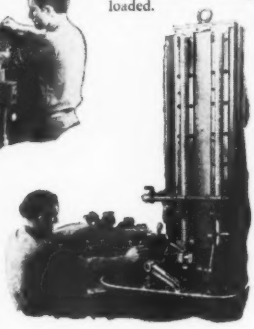


FAST PRODUCTION with high finish is obtained by broaching sides of articulated rod for aircraft engine, shown in position (left) on *American* SB-48-15-2 Single-Dual Machine.

NO INDUSTRY has gone more "all out" for war than the automotive. None manufactures a greater amount or variety of war matériel. For many years the industry has relied on broaching as a better way to do many metal-working jobs—the only *right* way to do some!

* * *

RELATIVELY LOW COST Single Ram Machine performs two different surface broaching operations. One tool (left) broaches flat on rod, while second fixture is being loaded.



RADII ARE FINISHED (right) with second broach while first fixture is being re-loaded. One operator plus one machine plus tooling by *American*—equals a precision job at a production rate!

BROACHING IS BETTER THE *American* WAY

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

Quality Control

Jessop WASHINGTON Carbon Tool Steel is a "high quality" steel specifically controlled in melting and treating to meet exacting requirements. Jessop Research has demonstrated that the balance of elements has an important effect upon the properties of carbon tool steel. Depth of hardening can be controlled by the proportion of manganese and silicon to carbon present in the steel. Jessop WASHINGTON is supplied with deep, medium, or shallow hardening characteristics when specified.

The high quality of Jessop WASHINGTON Carbon Tool Steel makes it particularly suitable for applications where service requirements are unusually severe, or where the cost of making the tool or die is high. *WRITE FOR BULLETIN NO. 142.*

JESSOP STEEL CO.
HEAD OFFICE AND WORKS
WASHINGTON, PENNA.

JESSOP STEEL CO. FINE JESSOP STEEL WASHINGTON, PA.
Established 1901

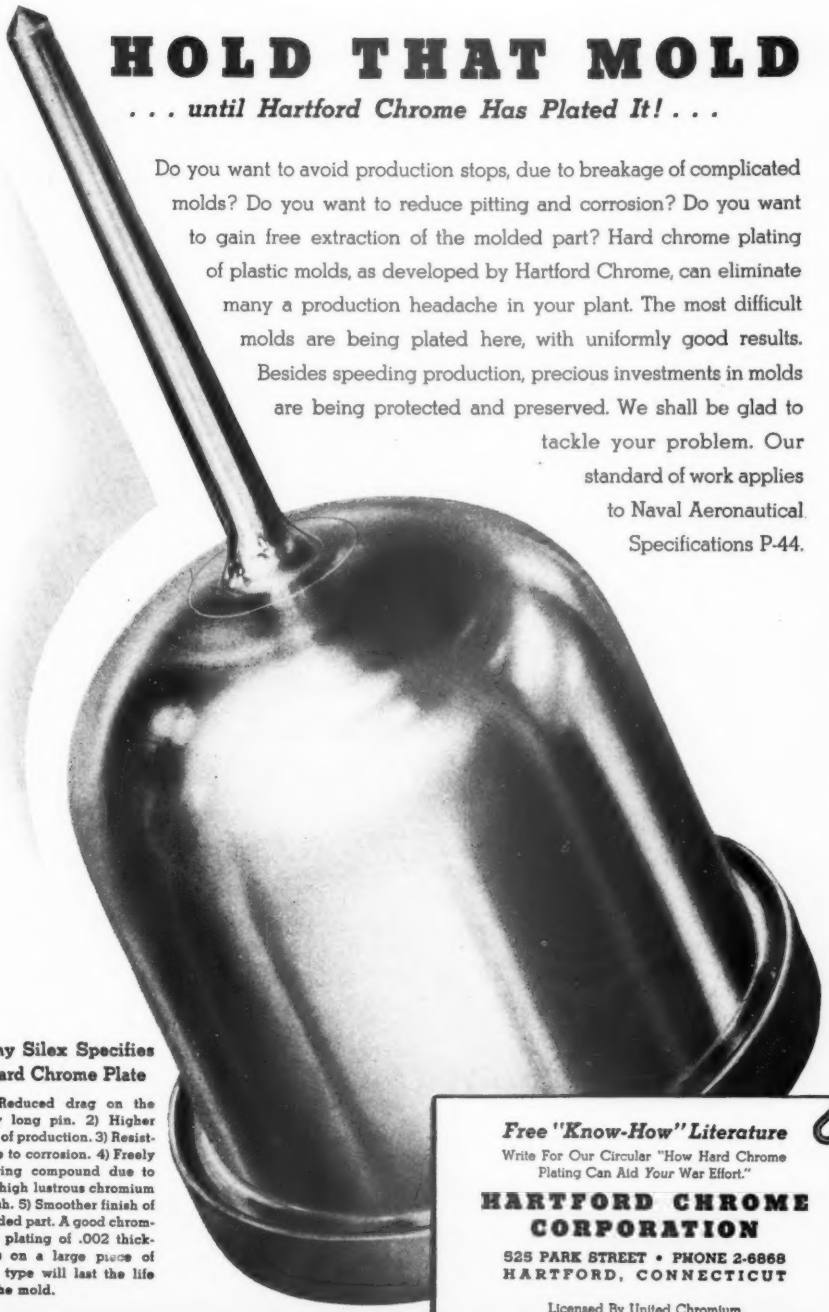
Carbon · High Speed · Composite Tool Steel · Special Alloy · Stainless · Stainless-Clad (Silver-Ply)

SUTTON TOOL CO DETROIT
Patented
DIAMOND GRIP
HOLDS TIGHTER • SELF-CLEANING
HEAVIER CUTS • FASTER FEEDS • FASTER CYCLES
Sutton Diamond Grip Collets boost production because the Diamond Grip takes horizontal and rotating thrusts at an angle, grips tight with 10% to 15% less tension, cuts slippage practically to zero even on heavier cuts and lets you step up machine cycles to the limit of the tools. DIAMOND GRIP is self-cleaning—dirt, scale and chips work out easily, do not load up as with the usual square-cut collets. DIAMOND GRIP costs no more than ordinary collets.
SUTTON TOOL CO.
2895 W. Grand Blvd.
Detroit • Michigan
See our representative or
send for Catalog 15
SUTTON
Diamond Grip
COLLETS

HOLD THAT MOLD

. . . until Hartford Chrome Has Plated It! . . .

Do you want to avoid production stops, due to breakage of complicated molds? Do you want to reduce pitting and corrosion? Do you want to gain free extraction of the molded part? Hard chrome plating of plastic molds, as developed by Hartford Chrome, can eliminate many a production headache in your plant. The most difficult molds are being plated here, with uniformly good results. Besides speeding production, precious investments in molds are being protected and preserved. We shall be glad to tackle your problem. Our standard of work applies to Naval Aeronautical Specifications P-44.



Why Silex Specifies Hard Chrome Plate

1) Reduced drag on the very long pin. 2) Higher rate of production. 3) Resistance to corrosion. 4) Freely flowing compound due to the high lustrous chromium finish. 5) Smoother finish of molded part. A good chromium plating of .002 thickness on a large piece of this type will last the life of the mold.

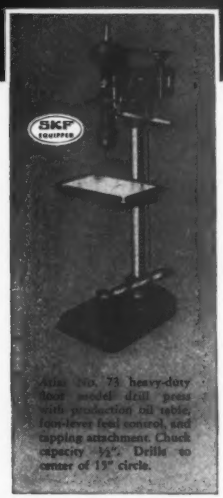
Free "Know-How" Literature

Write For Our Circular "How Hard Chrome Plating Can Aid *Your* War Effort."

HARTFORD CHROME CORPORATION

525 PARK STREET • PHONE 2-6868
HARTFORD, CONNECTICUT

Licensed By United Chromium



Atlas No. 73 heavy-duty floor model drill press with production oil table, four-lever feed control, and tapping attachment. Chuck capacity ½". Drills to center of 12" circle.

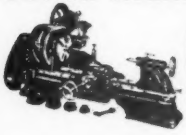
2, 3, and 4 SPINDLE MACHINES for Multiple Drilling and Tapping

When minutes are precious as they are right now, whole days of production can be saved each month by using Atlas Drilling Machines on parts that require a series of drilled and tapped holes. These inexpensive, efficient machines have massive production oil tables; solid type iron legs. Drilling heads are Atlas 4 SKF ball bearing floating-drive design with new crank-type head raising mechanism.

Investigate the speed-up possibilities of Atlas Drilling Machines. They are setting new operating records in many of the nation's largest plants. Atlas Press Company, 412 North Pitcher Street, Kalamazoo, Michigan.

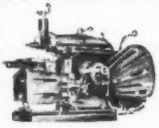
ARMY E NAVY

OTHER ATLAS EQUIPMENT FOR WAR PRODUCTION



LATHES Backgeared, screw-cutting lathes with V-belt drive, power cross feed.

SHAPERS Handle all work within a 7" stroke accurately, quickly.



MILLING MACHINES Compact, powerful bench millers for full range of milling work.

FOR QUICK ACTION

● Our wartime strategy of making wheels only 3″ in diameter and under is approved and endorsed by WPB. We make a 24-hour a day job of it. There is no let-up. All vitally needed wheels are shipped promptly. Our central location gives us a head start on deliveries.

Custom Built Wheels, just the right wheels for your particular job, no matter how precise or difficult it is.

The moment we have your grinding problem, it's turned over to abrasive engineers who make up the wheels that do your job better and faster.

*Half a century of specialization has established our reputation as the Small Wheel People of the Country.

Years of research and Specialized* experience are behind each Chicago Grinding Wheel.

You can depend on prompt deliveries. GET IN TOUCH WITH US!

TEST WHEEL—Tell us the kind of job and size wheel you need. We'll be glad to send one without charge.

CHICAGO WHEEL & MFG. CO.

1101 W. Monroe St. Dept. TD Chicago, Ill.

Send Catalog. Interested in TD-4

☐ Grinding Wheels ☐ Mounted Wheels ☐ Send Test Wheel. Size _____

NAME _____

ADDRESS _____

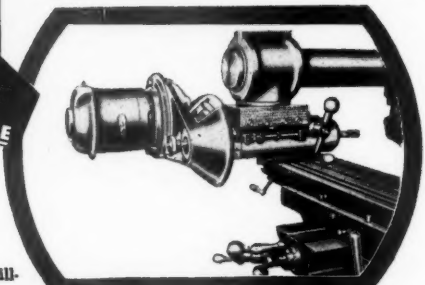
New HALCO UNIVERSAL HEAD

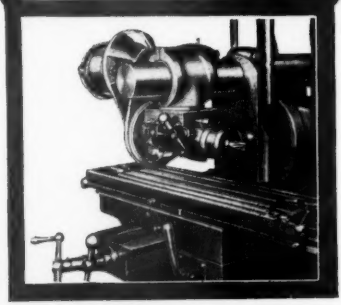
Only Machine Made On This Lathe Principle

for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at extra cost.

FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING ON ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

IMMEDIATE DELIVERY

(Designers and Builders of Fine Machine Tools)

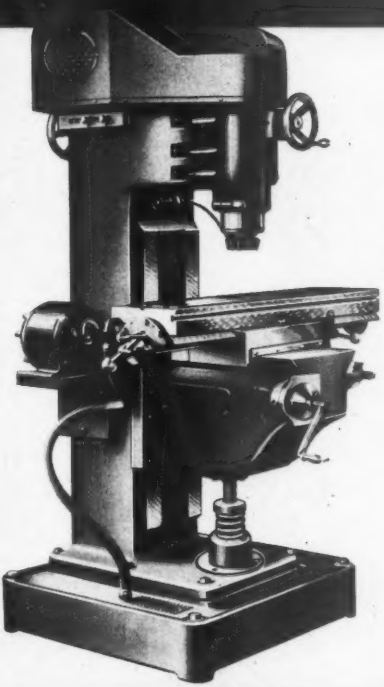
SEND TODAY FOR FOLDER

AJAX ENGINEERING & MFG. CO.

MANUFACTURERS OF HALCO PRODUCTS

14234 BIRWOOD AVE., DETROIT, MICH.

ANOTHER BOOST FOR VICTORY!



JACKSON No. 2½

Precision Built-Heavy Duty

VERTICAL MILLER

Drive: 1½ H. P. Motor; V-Belt, Worm and Worm Gear.

12 Speeds; 9"x 39" Table.

Travels: 14" vertical, 10" cross, 23" longitudinal; 4" vertical spindle.

Weight: 2400 pounds.

Long. Power Feed and Automatic Coolant.

Shipments now being scheduled for next '90 day deliveries under W. P. B. Order E-1-B. Phone or Wire.

JACKSON

MACHINE & TOOL COMPANY

• SALES DIVISION •

JACKSON, MICHIGAN

U. S. A.

SAVE PRODUCTION TIME
with a SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 57" above floor and lowers to within 8¼" of floor. Overall height 72". Size of platform 24"x24" steel plate. Crank, up and down, hoist unit.

Price
$147.50

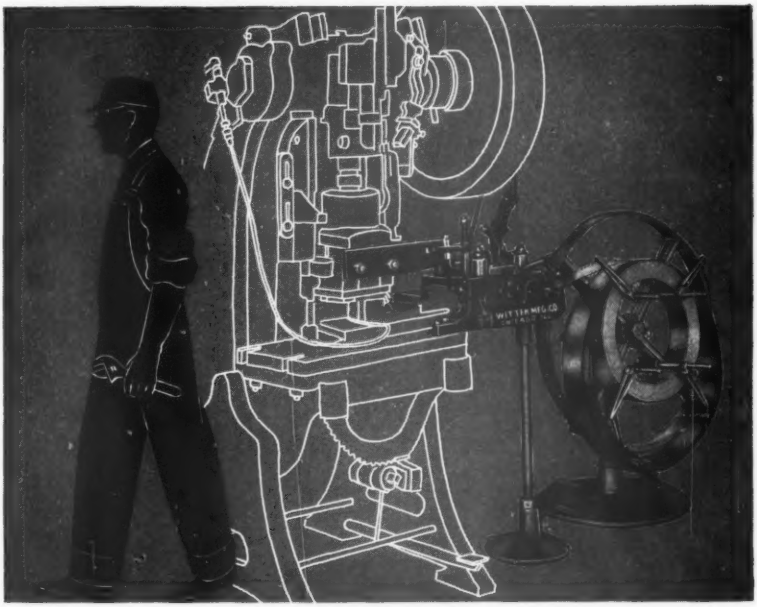
ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago

IMMEDIATE DELIVERY

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

★ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305-15 W. 24th Pl., Chicago, Ill.

COMMERCIAL HONING

EMPCO Honing on Contract
is now available to all Industries

Diameters 2 to 12 inches, lengths to 5 feet; one piece or a thousand

If you already know the economy of *stock-removal* and the superiority of *surface-finish* regularly attained with Empco Honing, we need only invite you to send your prints for estimates and delivery dates.

"A honed surface is a much longer wearing surface."

If you have not yet investigated this fast, modern, more economical method of better hole-finishing, let us tell you about it now.

THIS SERVICE AVAILABLE ONLY TO WAR INDUSTRIES

Prompt Service *Address Contract Honing Dept.*

EMPCO

ENTERPRISE MACHINE PARTS CORPORATION

2735 JEROME AVENUE • DETROIT, MICHIGAN

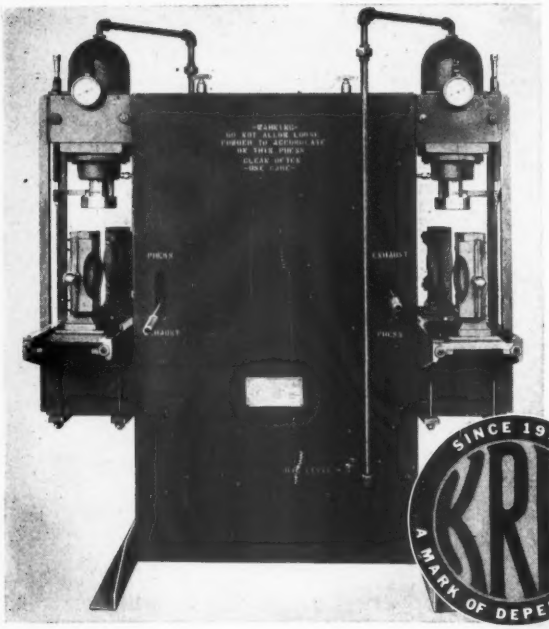
Tannewitz VARIABLE SPEED BAND SAWS

Instantly adjustable to the IDEAL Speed for cutting Metal of EACH and EVERY Type!

● In cutting off gates and risers from castings of various metals, practically any size, in cutting steel sheets up to ¼-inch thick, cast iron, plastics or any one of dozens of other cutting operations, a TANNEWITZ Variable Speed Metal Cutting Band Saw will do it quicker, better, and show a handsome return on the investment involved. There are five new models in addition to our regular High Speed Band Saws, including those which handle work as wide as 52 inches, and those with 48-inch clearance beneath the guide. Get a line on the TANNEWITZ metal cutting band saw that fits your particular needs. It will save time, step up production and repay its cost dozens of times. Write for full particulars NOW!

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

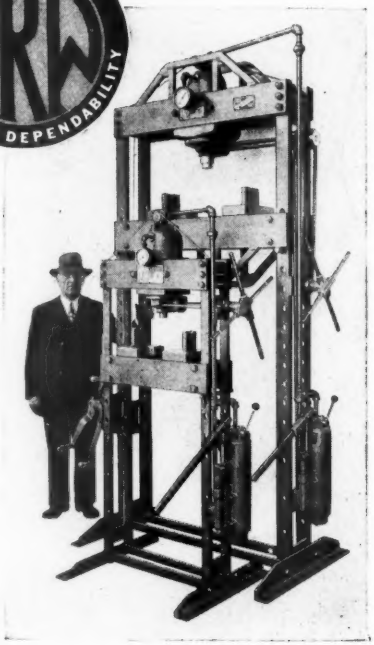
KRW HYDRAULIC ARBOR PRESSES



Engineered for War Production

★ ★

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 2E-ton unit.



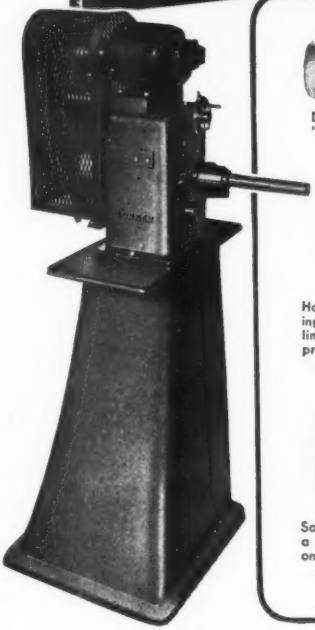
With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: The large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

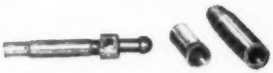
The SUNNEN PRECISION HONING MACHINE handles jobs like these faster, more accurately, at lower cost



Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Hardened Steel Inner Bearing Race honed to .00005" limit. Surface finish improved; errors of out-of-roundness eliminated.



Airplane Engine Parts accurately honed to a super-smooth finish.

"Produced an extremely accurate and glass-like finish."

Saved time in producing a smooth accurate finish on this bronze remote control valve body.

Aircraft Valve Tappet Roller. 4-Micro finish.

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Solves problems of finishing internal cylindrical surfaces. Inexpensive, yet accurate. Can be set up and work located in a minute. Does not require skilled labor.

Range .185" to 2.400" — accuracy guaranteed within .0001". Now being used by hundreds of manufacturers handling important war contracts.

Corrects errors of out-of-roundness or taper caused by previous operations. Produces super-smooth finishes. Maintains alignment established by previous operations. Facilitates duplication of sizes.

A Sunnen engineer will gladly call and show you what Sunnen equipment can do on your job. Or write for free bulletin giving complete information.

The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

SUNNEN

SUNNEN PRODUCTS COMPANY

7947 Manchester Avenue, St. Louis, Missouri

Canadian Factory: Chatham, Ontario

CUTTING-OFF

Now Made Much Easier for

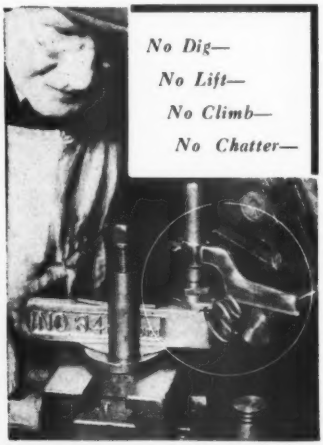
All Lathe Operators!

Lombard Power-Feed Tool Holder Eliminates All Chatter

Cutting-off in a lathe has always been a most difficult job, because the stock jumps, lifts, and climbs on the tool. All this is now made impossible with the Lombard Tool Holder, because it is equipped with a steady-rest that rides over the work. Holds work down. Stock can't lift. Operates smoothly, without vibration. Makes cutting-off a pleasure.

Makes Cut-off Blades Last Much Longer

—because the steady-rest supports and protects the blades against sudden lifts of the stock.



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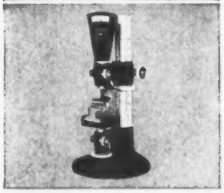

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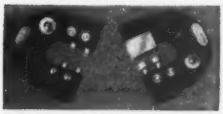

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Photo Courtesy Bell Aircraft Corporation

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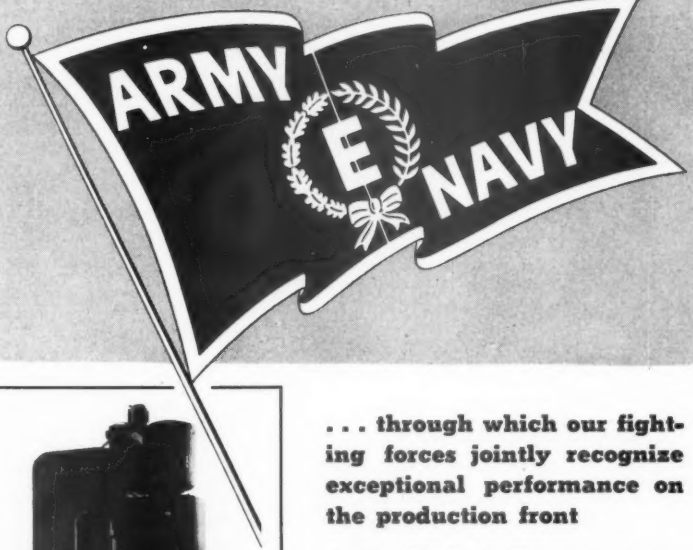

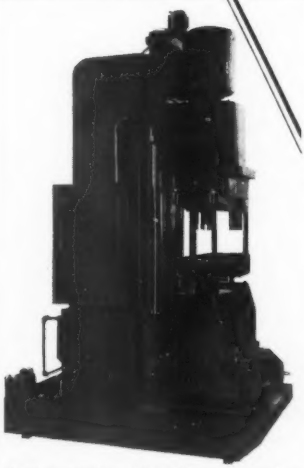

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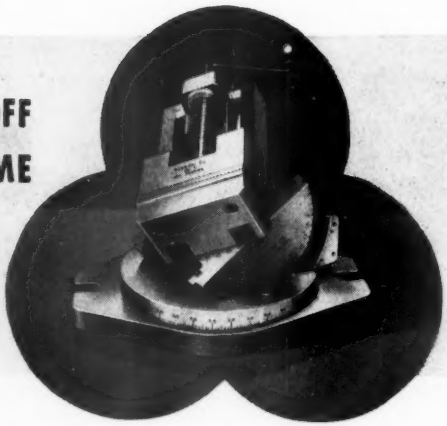

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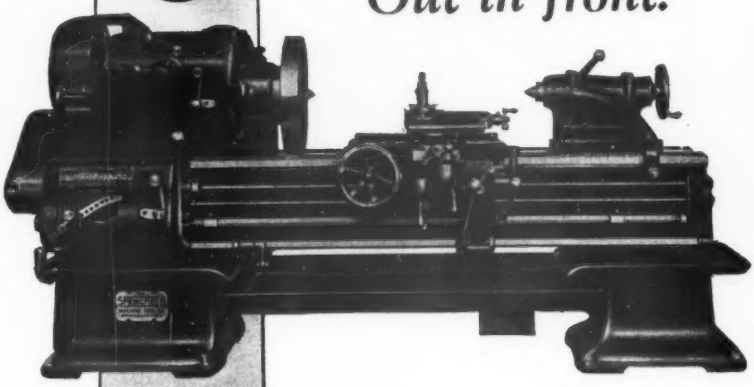

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NEW ADDED FEATURES!

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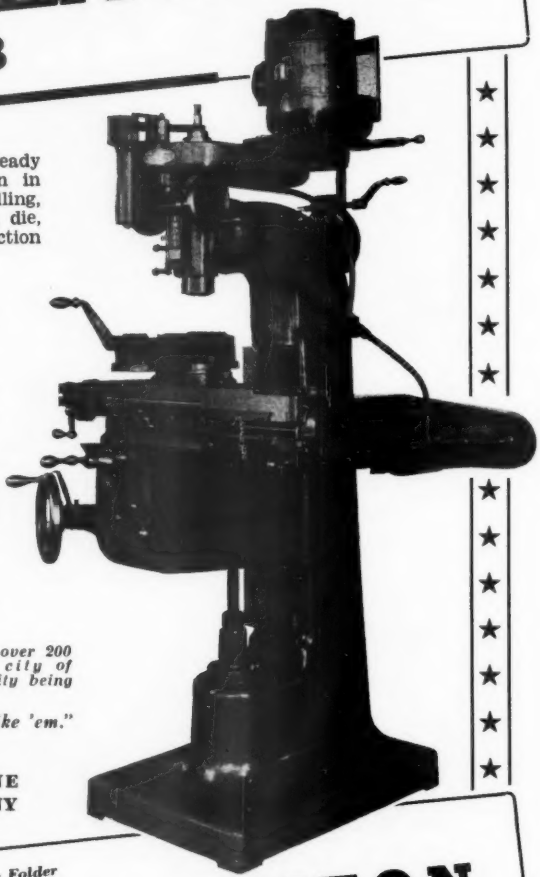

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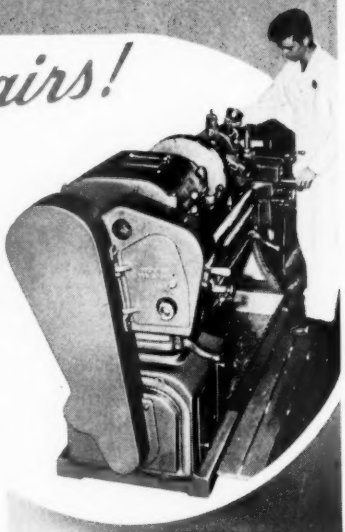

WHEN mechanical repairs are needed, the Sebastian Precision Lathes at Pan-American Airways bases throughout the world are entrusted with the important job of turning out necessary fittings, tools, and other essential parts. Then the Clippers are off again, flying old routes, pioneering new routes, establishing new world skyway routes for the peace to come.

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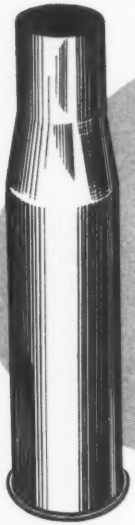

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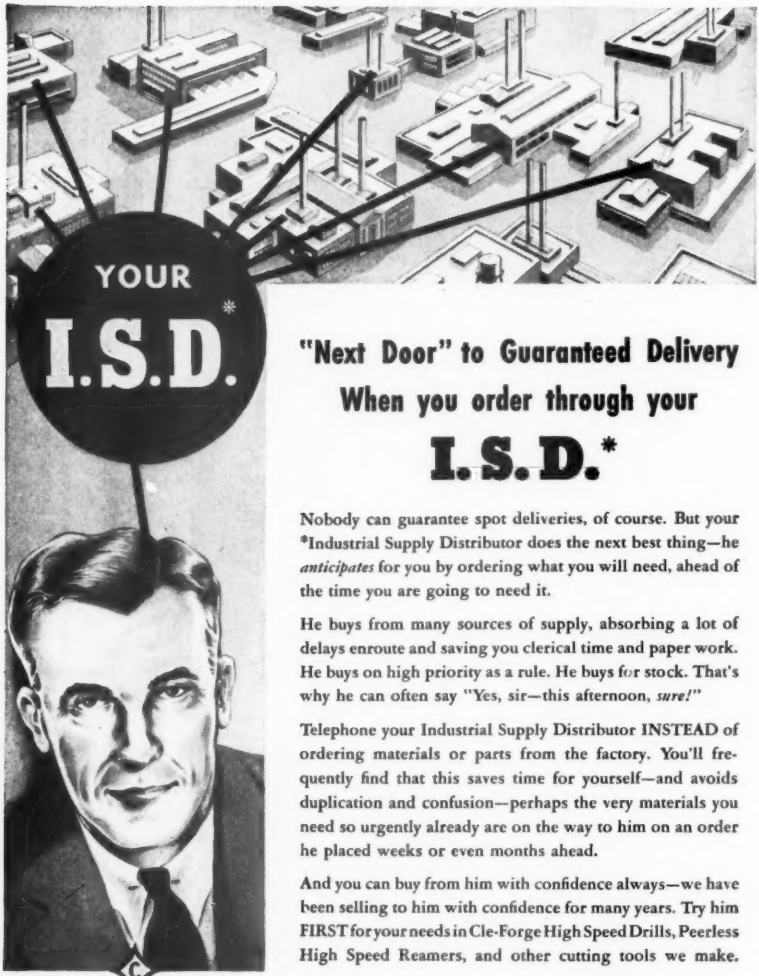

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Time to plan

THE flow of most war production is daily becoming smoother. But to continue to increase it may be difficult. Skilled manpower is an ever present problem and will be, so long as men must be drawn from industry for the Armed Services.

The great efforts which most manufacturers have made to train new employees, particularly women, are beginning to show some results, but experienced men for supervision are no longer available in sufficient numbers. Needed tool, die and gage makers are daily becoming fewer.

There are not as many new tooling programs, but the demand for some expendable tools for continuing production is greater than ever. Qualified facilities for making dies for aluminum aircraft forgings are in demand and precision machining facilities are still being sought.

The problem of helping smaller plants to fit themselves into the production of war items is receiving the earnest attention of Smaller War Plants Corporation field officers. The fact must be faced that many of those who need contracts do not have the equipment nor the "know-how" requisite to manufacture either the close tolerance parts or the highly specialized products which are bought by the procurement agencies among officials who are responsible for production policies. The hope is strong that the opportunity for opening the door to the civilian goods field a little wider is not far distant. Raw materials are still the problem.

Which brings us to the fact that one day the war will end. Planning for that day and the period that will follow is a highly controversial subject. Is this the time to plan? Or shall we wait until the war is won?

We believe that right now is the time to do some very serious thinking about that post-war period. We are going to see, naturally, a changed Europe and Asia and Africa; we are seeing now, and living in, a changed United States of America. Just stop a moment and reflect upon what changes have been wrought here among us during and since we came out of the distressing days of the early thirties and into these, in some ways, equally distressing days of the early forties! Consider our system of social security and the development of trade unionism, to mention only two. Both are with us to stay, and who is to say they shouldn't be. In a democratically governed country like ours, regulations and controls came as the result of popular opinion, but only as it makes itself heard and felt.

Either Industry and Business or Government will have to lead off in the transitional period after the war. Or better still, let it be a coalition with Industry supplying the initiative and the energy, and Government the cooperation which will assure all groups of its citizens the equal rights and benefits to which they are entitled. Let our Government add to this the intelligent supervision of all groups and individuals and the restraint of those which require it and we should be on the way to the development of a domestic economy which will prove to all the world that we practice what we preach.

Such planning for the post-war period must begin today in the thought of the individual. As it takes form in action it develops cooperative planning within Industry with its equitable distribution of wages and profits and the elimination of the disagreements which are always costly to employer and employee.

Finally, let every man give thought to one of America's greatest freedoms, one which is so frequently neglected, that of casting his ballot for the man who expresses his idea of sound democratic government.

Geo. J. Huebner

Editor and Publisher

This message comes from Washington, where Mr. Huebner is serving as chief of the Tooling Section in WPB's Smaller War Plants Corporation.

N. M. Olney, M. E.
Western Electric Co.

DEEP DRAWING RECTANGULAR SHELLS

THE subject of rectangular deep drawn shells generally involves considerable time, effort and expense prior to reaching a final solution. In round shells the problems of blank development, punch clearance, drawing radius and strain are comparatively simple in view of concentricity of section. In rectangular shells greater difficulty is encountered in view of the combined forming and drawing action and consequent unequal stresses created in corners and side walls. The particular case history cited herein is intended to illustrate the possibility of attaining reductions far beyond conventional expectations by employing the correct type of tool, proper drawing radius and proper clearances between punch and die. Resultant savings are fewer operations, less cost and less equipment tie-up—all so essential at this time. Shells of this type are used as containers for telephone and radio apparatus acting as shields for high frequency currents. The shell under discussion is illustrated in Fig. 1. It is made of .028 copper and was produced in four operations. Although details governing die design have not been discussed in any considerable detail, the type of tools used were conventional in design and will be referred to in a general sense.

The first operation (Fig. 2) called for a combination blank and draw die and was run in a single action press. It is interesting to note that the percentage of reduction represents approximately 60% of the blank layout. (Shown in Fig. 7.) This was found to be maximum reduction which could be attained in one operation with safety. Attention is called to the shape of the upper edge of this first operation shell. Although the reason for the shorter height at the corners ($2\frac{5}{32}$") is well known to most designers and die makers, it might be well to reiterate this important point. The height of the shell at the corners is made shorter in consideration of the fact that the material at the corners will rise far more rapidly than the sides with each succeeding draw. Proper blank development must compensate for these changes in order that, in the final draw, the shell will be as even as possible in height. In drawing soft metals like copper or brass into rectangular or square shapes it is important not to overstrain the metal at the end of the stroke due to accumulated drawing pressure. The high points of the blank are the last parts of the material to be drawn at the close of the stroke. Consequently, this built-up drawing pressure is concentrated at these points, with the result that the metal is thinned out to nearly a knife edge and contributes to the creation of slivers with their attending troubles. To overcome this condition, first operation drawing dies designed for use in single action presses are generally made with the pressure pad and outside of the punch

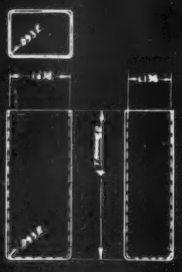


FIG 1
(MATERIAL 02B COPPER)

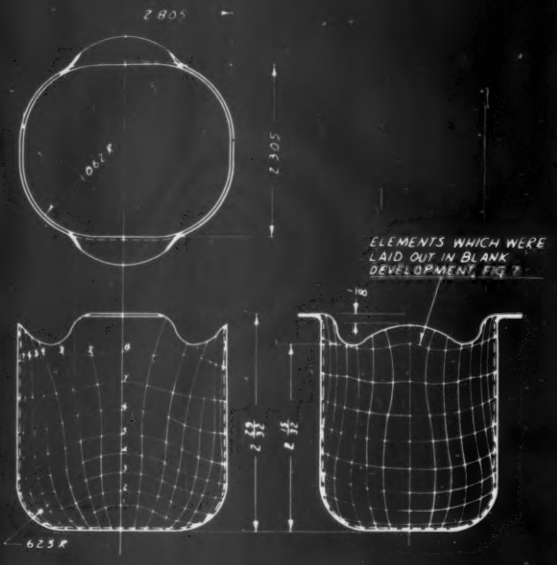


FIG 2
FIRST OPERATION BLANK AND DRAW SHELL

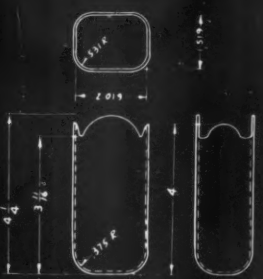


FIG 3
(1ST REDRAW)

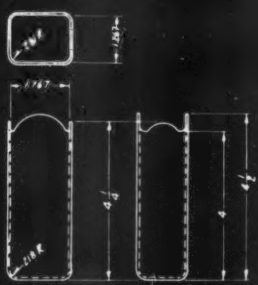


FIG 4
(2ND REDRAW)

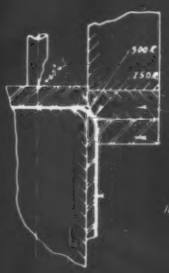


FIG 5 SECTION THRU 1ST REDRAWING DIE

larger than the blank. (Fig. 9.) By providing a recess in the pressure pad in depth equal to approximately the stock thickness, little or no pressure is exerted on the flange, thus eliminating "thinning out" of the flange at the close of the stroke. In combination dies it is obviously impossible to make the punch larger since the punch and pressure pad must be similar in size and shape to the blank in order to blank and draw in combination. However, in order to achieve the same effect in a die of this type and eliminate the trouble, a recess was provided in the pressure pad .002 deeper than the stock thickness and similar in shape to the blank but approximately $\frac{3}{32}$" smaller along the side. Since the flange of the shell becomes smaller as the drawing action progresses, it is readily apparent that a blank resting on this narrow surface will not be drawn to any appreciable depth before it will be in the recess. As soon as this occurs, the blank will be confined between pad and punch without any further pressure being exerted upon it, and the shell will be drawn to the required height without the edge being thinned out. Figure 8 illustrates two positions of the die. "A" shows the start of stroke with the blank sheared through and the punch bearing upon it against the pressure pad. "B" indicates that drawing has started and the blank is confined in the recess.*

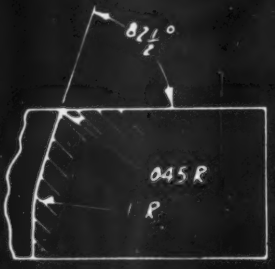
With further reference to the first operation shell in Fig. 2, a corner radius of $1\frac{1}{16}$" and a drawing radius of .250 on the punch provided satisfactory results. The clearance between punch and die at the side walls was .035 and .037 at the corners. This may appear excessive; however, it was found that this produced a smooth shell free from wrinkles and no sign of overstrain. Incidentally, this clearance takes into account the thickening of the shell wall due to compressive stresses which occur during drawing. Although the amount of thickening and thinning of the metal is of considerable importance, the variations after the first draw were not sufficient to warrant further discussion at this point.

The first redrawing operation was likewise run in a single action press. Briefly the die consisted essentially of the punch and inside blank holder mounted on the die shoe with spring pressure below and the die mounted on the punch holder. From the dimensions in Fig. 3 it will be seen that this reduction represents approximately 30%. This is in excess of general practice for a first redraw; however, it was found to be perfectly feasible and practical. Prior to redrawing, the shell was annealed at 500° F for five minutes. The corner radius in the die was .531 and the drawing radius contour is shown in Fig. 5. Without this particular contour the job would be impossible. Repeated trials of various radii proved unworkable. During development it was found that the shell could be drawn to a depth of only ¼ of its height without breaking. Upon removal, the broken shell appeared to have flattened at the bottom, especially at the corners, that is, in place of a radius the corners were practically square. This indicated that the shell had to be provided with an easier drawing contour through which to pass and, in addition, had to be supported to prevent collapsing or squaring at the bottom and consequent breaking. A nest was provided which consisted of a tool steel ring 1" thick, the inside of which conformed to the outside of the first operation shell. This ring was fastened to the punch and during drawing the metal was thus confined between this ring and the inside blank holder. The redrawn shell was checked for change in wall thickness and indicated along the upper end .037 at the corners, and .020 at the sides. The clearance used between punch and die was .032 at the walls and .037 at the corners.

Design of the second redraw die (Fig. 10) was of the "push through type" and was run in a single action press. The shell is shown in Fig. 4. An inside blank holder was provided and mounted on the punch. A light spring pressure was used in view of the small reduction. The inside blank holder was made a sliding fit on the punch and held thereto by means of 2 studs, the ends of which engaged 2 milled keyways along the sides of the punch. The heavy flange indicated at "s" was included to add dead

(Continued on Page 217)

*Patent Pending.



RADIUS CONTOUR OF 3RD REDRAWING DIE (SECTION)

FIG 6

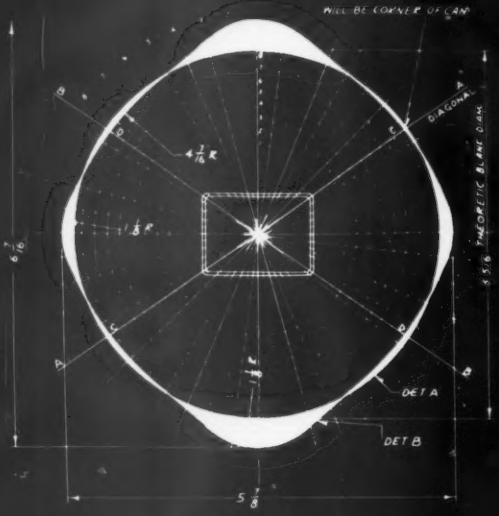


FIG 7
BLANK DEVELOPMENT LAYOUT

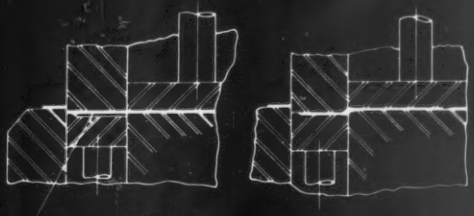


FIG 8

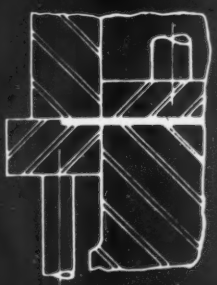


FIG 9

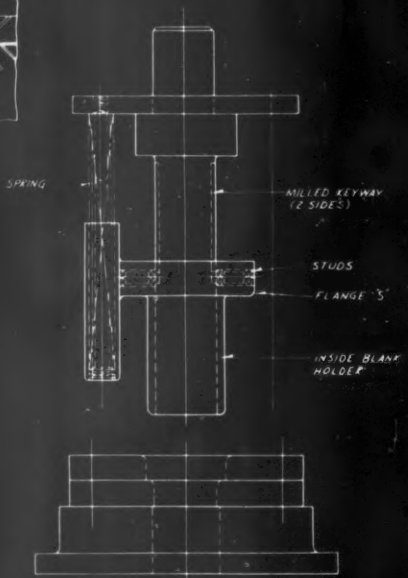


FIG 10
2ND REDRAW DIE

Charles M. Brehm
The Steel Products Engineering Co.

UNIQUE DIE TRIMS SHELLS IN ONE PRESS OPERATION

IN the production of shells drawn from sheet metal, it is usually necessary that they be trimmed to their required height. Now being used for this operation is the Brehm trimming die—often called "the shimmy die." This unique tool trims round, square or irregular shaped shells in one press operation with perfectly flat and straight edges as if turned on a lathe.

In the construction of these dies, the cutting edges of the punch and die are very similar to those of a blanking die. In operation, the cutting movement is different. In blanking dies, one cutting member moves in a vertical direction with the cutting clearance between the contour of the punch and the die opening. In a Brehm trimming die, the punch fits the inside of the shell, the die opening fits the outside and the cutting movement is lateral with the cutting clearance between the punch and die faces.

The opening in the die cutting member is a slip fit to the shell at the trim line. The punch clears the inside of the shell, whatever its shape may be. To the face of the punch there is attached a movable gage member whose length is equal to the required depth of the trimmed part. Above the punch is mounted a series of studs slightly longer than the punch, the difference representing the cutting clearance. Within the die opening is a spring-actuated ejector which supports the shell.

When in operation, as the die closes, the shell is pressed down in the die opening against the spring ejector until the studs about the punch contact the die face. By means of a series of cams, the continued downward stroke of the press causes the die cutting members to move laterally toward the center from several directions, shearing off a portion of the scrap with each cam movement. By the end of the down stroke all cams have functioned and the entire scrap has been removed. During the entire stroke the shell is held in one position so that the portions of the edge trimmed with each cam movement blend together into one smooth edge.

During the downward and return travel of the die member, it is supported by springs or an air cushion, similar to a draw die.

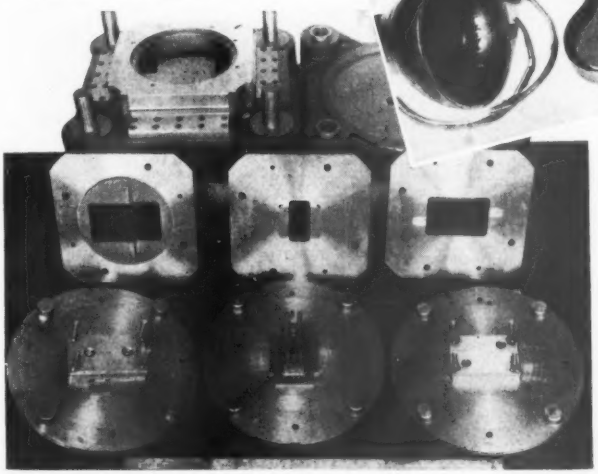
In the construction of Brehm dies, the punch and studs are mounted on a plate. This punch plate and the die plate can easily be removed, making it possible to interchange the cutting members and trim a variety of shells in one die. Dies equipped to trim six or eight different sized or shaped shells are common, while a wrist watch case manufacturer at one time had 32 active sets of adapters for one die.

In some cases, it is possible to trim shells with notches or projections on the edge as shown in Fig. 1. If more than one notch or projection is required, their location with each other or to a corner,

Fig. 1—Brehm die for trimming shells of .218 steel stock 7.1700 diameter. This die operates on an air cushion in line production.

Fig. 2—Typical of the result achieved with Brehm dies.

Fig. 3—Brehm die with both punch and die cutting members for three shells.



as in a square shell, may prevent obtaining this type edge.

Curved edges, such as are required for curved wrist watch cases, and other parts shown in Fig. 1 have been obtained but there are limitations in the case of notches or projections.

One factor in obtaining straight trimmed edges without burrs is controlling the cutting clearance between the faces of the punch and die cutting members. The pressure studs mounted about the punch and the punch itself are ground to length by surface grinding. By grinding the punch shorter than the studs a definite, uniform cutting clearance is obtained between the punch and die.

The cutting clearance allowed in this type of die will vary somewhat from that usually given blanking dies. This variation can be partially attributed to the extent the material has become crystallized at the trim line by multiple draw operations and the number of annealing operations, if any, between draws. On one part made of .010" brass, .001" cutting clearance gave excellent results. On a shell of .218" steel best results were obtained with .013" clearance while on a second part of the same gage but different size .008" clearance worked best.

The trimmed edge from these dies is similar to those obtained in blanking dies. A portion of the inside edge will show the metal has been cut while the outside portion will show a fracture. This breaking of the outside portion is the principal factor in the elimination of burrs on the trimmed part. Any burrs due to dull cutting members will be on the outside corner of the trimmed edge where they may be easily removed. All trimmed edges will be just as straight as the ground faces of the cutting members.

To determine the height of a trimmed shell the part is gauged from the inside on the bottom. On watch case parts, the variation was held to plus or minus .001". On large deep shells variations have been held to plus or minus .003".

There are several methods of trimming shells on a punch press that leave them with a flare to the trimmed edge or show the cut edge of the metal on the sides. When trimmed by the Brehm method, they are drawn to their correct shape, past the trim line, giving a trimmed part with a correct shape and smooth, straight sides at the top.

The production from the trimming operation would be approximately the same as might be obtained in a forming or piercing operation on the same part if run in the same press as the trimming operation. The shells are dropped into the die opening and can be removed manually or by air. The clover leaf shaped shell in Fig. 1 is being trimmed at the rate of 10,000 per eight-hour shift. Approximately 30,000,000 of these parts have been trimmed in the past two years. The ends of burial vaults of .109" steel have been trimmed at the rate of 2,000 in six hours. Electric refrigerator doors in line production have been run at 135 per hour.

To trim shells of unusual length or of various lengths of tubing, dies of this type have been developed to be operated in a horizontal position in the press.

The top member of the die set, normally the punch holder, is toward the front of the press bed and carries the cutting member. The die shoe is toward the back and carries the cam member which in turn carries the punch. The work is inserted through a hole through the punch holder into the die cutting member. Gaging of parts is usually from a stop, or in case of formed tubing, from a form block mounted on the front face of the punch holder.

In this design, the power from the press is applied to the bottom of the die shoe by means of angular cams, one attached to the shoe and the other to the press slide.

Finished dies are not carried in stock by the manufacturers but each one is built to the requirements of the press available for the operation. This is partially due to the fact that these dies require longer strokes than for most press operations and the variety of die spaces in long stroke presses vary to such extents it would be impossible to stock finished dies.

In the usual construction of these dies, the gage is attached to the face of

(Continued on Page 195)

Glen H. Howell
Drive-All Mfg. Co.

THE APPLICATION OF UNIT DRIVES TO MACHINE TOOLS

IN a previous issue (February, 1943) the discussion of unit drives centered primarily around some of the historical aspects of this subject. Through years of research and development, much has been accomplished that would warrant comment. Many problems that seemed almost without solution were overcome. As worthwhile as all this is, the real significance of the entire project lies in the present day selection, application and use of unit drives. In this article, therefore, we propose to discuss these problems in more detail so as to be able to reach some definite conclusions.

The obvious and immediate question that should be asked is, "Why should I install individual unit drives?" This question must be satisfactorily answered before any other. Let us, then, look at a few of the most important of these answers.

Of prime importance, in days when manufacturing space is at such a premium and extensive expansion is the rule, is the fact that when a machine is equipped with a unit drive, that machine can be placed wherever there is room for it. There is no necessity of aligning it with existing shafting or drives except insofar as such alignment is advantageous to the operation. If there is room for the machine, the operator and the material in process, and if an efficient line of flow of material can be maintained, then the running of the electrical circuits, the only remaining problem, is usually of minor importance.

Figure 2 shows a shop where unit drives are used exclusively. This shop illustrates in an outstanding manner all of the many advantages of unit drives. Part of a letter from this company states that:

"Our engine lathes formerly operated at from 300 to 320 rpm. These speeds have been doubled and in two cases are running 700 rpm. In addition, the units' added pulling power over the belt and cone method has enabled us to increase cutting feeds from .004"-.006" to .015"-.036". These speeds with the proper cutting tools have doubled our lathe production.

"In the past, our planers were operating on a 35 fpm cutting speed only. This is now changed to 20, 40 and 80 fpm. Our cast iron, aluminum, brass and monel parts are run at the highest (80 fpm) speed, more than double the previous speed. Steel parts are run approximately 14% faster, leaving the 20 fpm for unusually tough jobs.

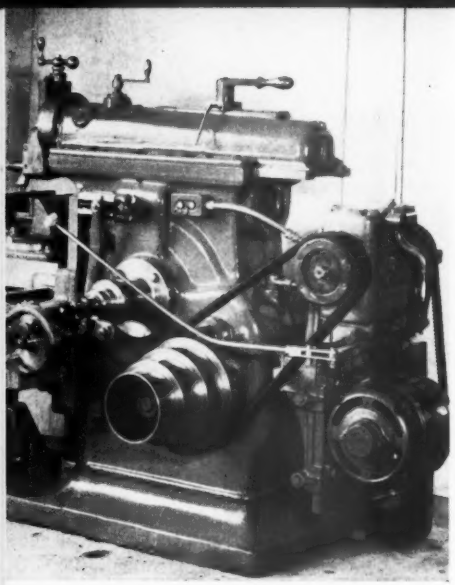


Fig. 1—Variable speed transmission unit drive applied to a shaper.

"Added to the above facts are, of course, a decided decrease in maintenance, the elimination of belts, line and countershafts, maximum light and quieter working conditions."

Added significance of unit drives is likewise apparent whenever a relocation of machines, for one reason or another, must be undertaken. It is a relatively simple job to make a move of one foot, to the next floor, or to the next town when a single piece of equipment is involved, in comparison with the effort of moving main shafting, countershafting, pulleys, bearings, belts, etc.

When we see the number of places now being used for machine work where no kind of industrial work has ever been previously done, we can well pause and ponder. Generally speaking, such a shop would never have been able to get started if a heavy superstructure to support overhead shafting had been necessary. Two factors would have entered into the problem: first, would the building carry these excessive loads and, secondly, would the owner be able to stand the additional expense of such a superstructure?

To quote an actual instance, a Michigan concern completely motorized a relocated department for less than the additional cost of steel to support the overhead shafting. Maintenance of line shafting was eliminated and the steel is now available for more important uses.

American industry has performed miracles since Pearl Harbor, and a very vital factor in that performance has been the small operator using his basement, garage, store, warehouse, or any other building he could get to house one or two machines. This is another of the many places where unit drives have more than proven their worth.

All competitive industries are faced with the problem of keeping the minimum safe margin between income and expense. There are two ways this can be done. First, the price of the product can be increased, or secondly, the cost of production can be decreased. Of course, the latter is the logical starting point if we wish to remain competitive. These decreases can be made at several points along the line, but our concern at the moment is in obtaining

(Continued on Page 196)

Fig. 2—A shop completely equipped with unit drives.

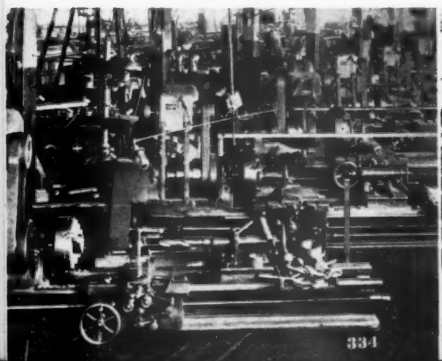
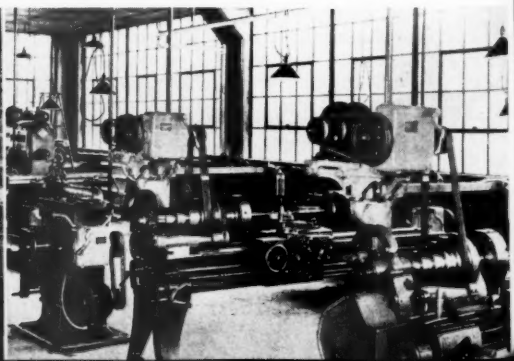


Fig. 3—Variable speed transmission unit drive applied to lathes.



C. W. Hinman
Designing Engineer

MODERN MILLING FIXTURE DESIGN

DURING World War I, milling cutters were made either from carbon steels or high speed steels, but occasionally inserted Stellite teeth were used. About 1930, milling teeth tipped with cemented carbide came into use because of a lower price for this material. Today, the use of high speed steel cutters predominates, but slitting cutters and other small carbon steel cutters are still used for slotting screw heads and other light cuts.

Most heavy-duty plain milling cutters are also made of high speed steels. These cutters can be safely run at two to three times as many cutting feet per minute as carbon steel cutters. Contrary to what many suppose, the feed per revolution of high speed steel cutters cannot be increased above those for carbon steel cutters of equal diameters. The only advantage, then, in using high speed steel cutters lies in the fact that they can be run several times faster than carbon steel cutters without showing cutting edge failure when taking similar cuts. Inserted blades of Stellite cutters "stand up" better than high speed steel and can be run at a greater circumferential travel in feet per minute without showing cutting edge failure.

Inserted blades with tipped edges of sintered carbide are now replacing all other cutting materials used for milling cast iron, and cutting speeds in feet per minute can be more than double those of high speed steel cutters. Furthermore, the extreme hardness of carbides permits using a smaller allowance of metal for finishing the work. This advantage saves power, increases production and reduces costs.

How Many Teeth in Milling Cutters?

There is no dependable rule that governs the number of teeth required in milling cutters. However, the modern tendency is to use "coarse tooth" cutters. It is found that with greater than usual spaces between the teeth, more chip clearance is provided, clogging is prevented, less power is required to drive, and smoother cuts can be obtained. Of course, the speed of the cutter and the kind of material being cut must be considered. Depending on the work materials, speeds and feeds, the number of teeth on different diameters of commercial milling cutters have been found to cover a wide range.

The number of teeth in milling cutters should be governed by the number of teeth per inch of cutter diameter. This sensible rule is a new application of the mathematics for computing the number of teeth in spur gears by using the so-called "diametral pitch" factor. The

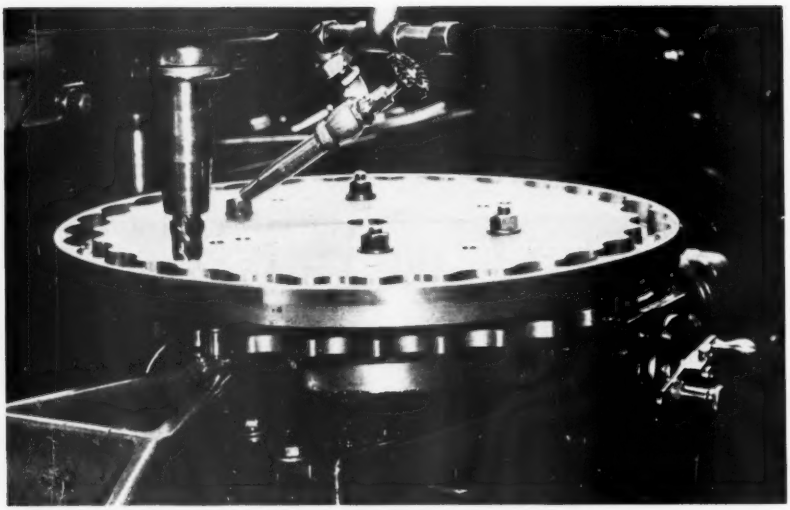


Fig. 92 — A profile end milling operation as performed in a vertical spindle milling machine. The cutter is slightly tapered and has spiral teeth which enables each tooth to take cuts gradually, thus reducing shock and chatter. A coolant is supplied on the cut through the pipe and nozzle over the center of the fixture.

diametral pitch in gears is the number of gear teeth to each inch of the pitch diameter. This rule can be a great help to milling cutter designers. For example: Suppose it is found that a milling cutter 3" in diameter having 12 teeth gave very satisfactory results for cutting cast iron. This cutter would have a "pitch" of 4 teeth per inch of diameter. Therefore, for obtaining the same results in another cutter 4½" in diameter, the required number of teeth would be 4 x 4½ or 18. Practice would determine the satisfactory "tooth pitch" in cutters for various materials. It may be 5 for steel, 4 for cast iron, 3 for brass and 2 for aluminum. By this method a standard for the number of milling teeth for all diameters of cutters and for cutting any material may be established.

Spiral Milling Cutters

Spiral teeth milling cutters are made either with a right or left-hand spiral. (See Fig. 45 of this series in the August 1942 issue of THE TOOL & DIE JOURNAL.) The direction of the spiral determines whether the chips will be delivered at the front or rear of the milling machine table and whether the cutting thrust is forced against the arbor bearing, as it should be for both climb and conventional milling.

The spiral is usually specified "one turn in 20, 25 or 30 in.," and the angle of the spiral must also be specified for the toolmaker to follow. With all the dimensions in inches, and if L is the length of the spiral in one turn, D the diameter of the cutter, and A the angle of the spiral, then $\tan A = \frac{\pi D}{L}$. Right and left-hand cutters are determined by the direction of their rotation when viewed from a position in front of the machine. Left-hand cutters revolve clockwise and right-hand cutters revolve counterclockwise.

A Rotary Milling Fixture

Figure 92 represents a rotary milling fixture for indexing and profile end milling 32 notched spaces on the edges of circular cams. The work is a part of

an airplane supercharger housing which is finally assembled into the necessary equipment in Army and Navy planes for high altitude flying. The milling of the notches is controlled by the master cam shown mounted on a rotary table in the fixture.

The fixture body is of cast semisteel and is bolted securely on the milling machine table. An overhanging arm carries an idle roller which is in contact with the edge of the master cam. With this simple arrangement and a crank and indexing plate in front of the fixture, the operator controls the cuts. The shape and depth of the notches cut in the work can never be different from those of the master cam.

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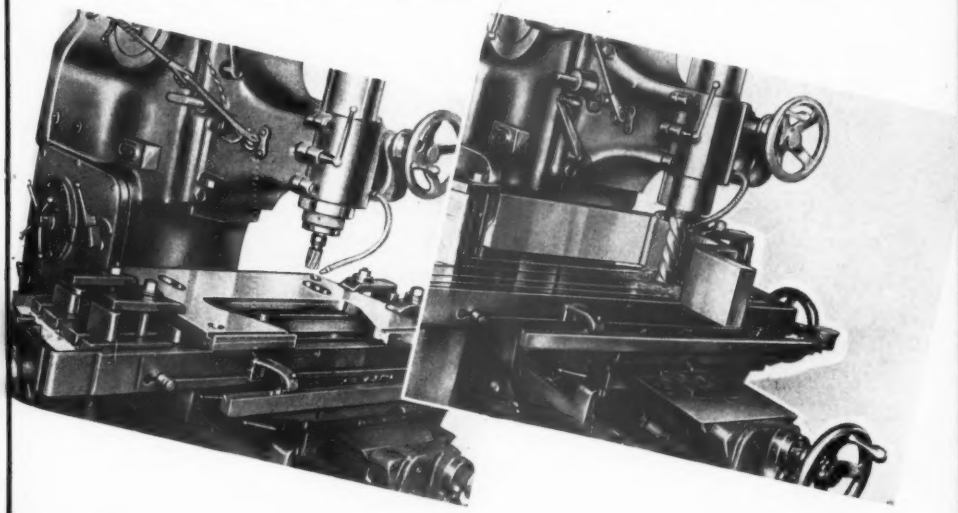
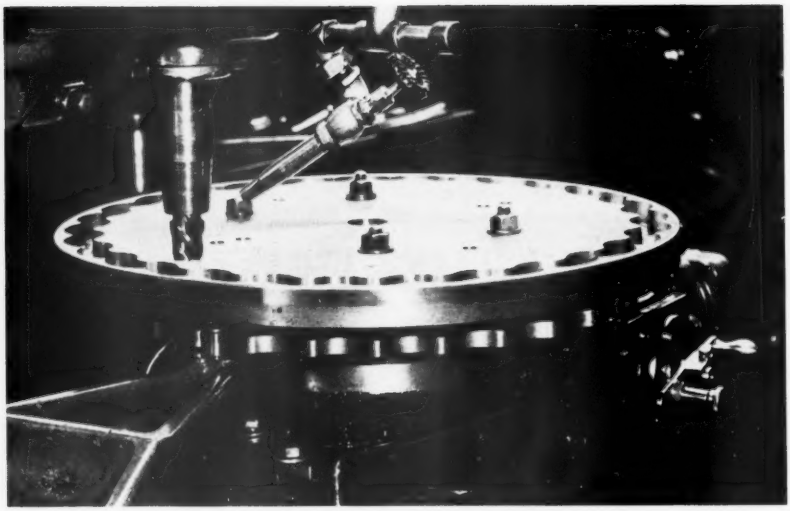
Fig. 93 — Milling a large 1″ thick steel plate for a tank part. Several operations, including profiling, boring, slotting and keyway cutting, are possible at one setting, because of a wide range of spindle speeds in the machine

Fig. 94 — Side milling a large steel forging on which a 2″ diameter spiral cutter 6″ long is used to remove as much as 5/16″ of stock at some places without appreciable spindle deflection. This forging is machined all over and passes a rigid inspection for finish and tolerances.

End Milling and Boring

Figures 93, 94, 95 and 96 are illustrations of work held by end clamps for





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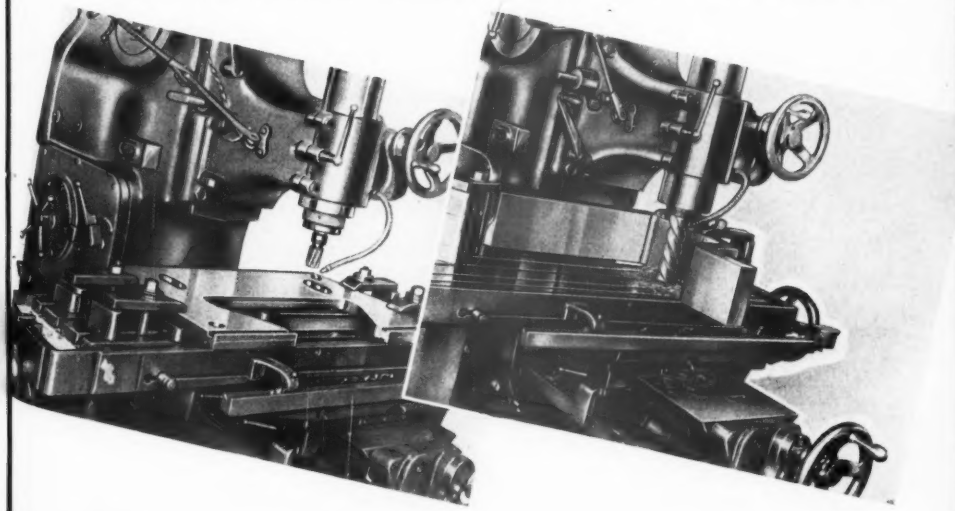


Fig. 95 — Boring a heavy steel plate used for an upper die holder. This work is 16″ x 29″ x 2″ thick. Nine holes, ranging from 1⅛″ to 2″ diameter, are accurately bored within limits of plus or minus .0005″. Dial indicators, shown attached, are used for quick and accurate location of the holes to be bored.

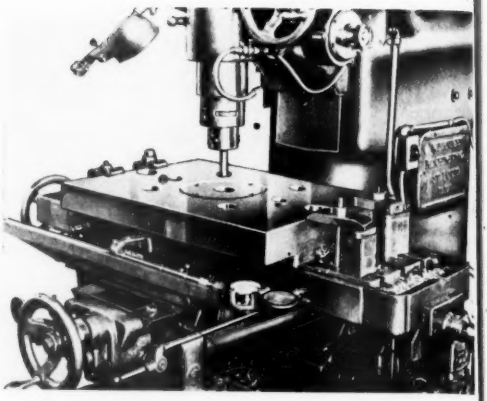
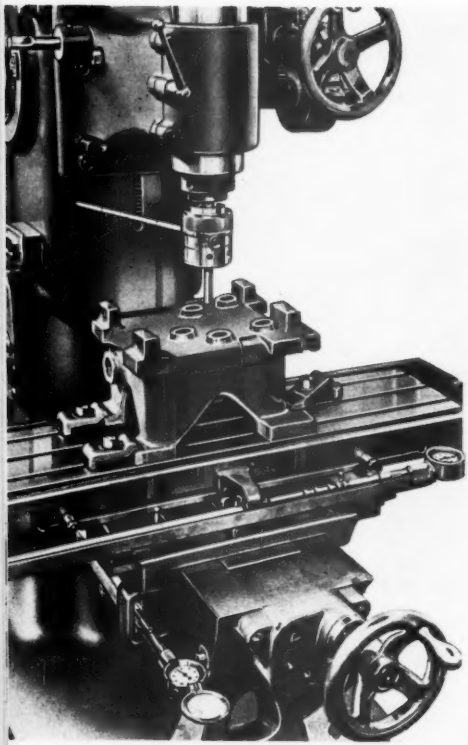


Fig. 96 — A typical jig boring job done in a vertical spindle milling machine using a fly cutter. The work is clamped on four finished pads. Five holes are accurately located and bored in one setting by using the dial indicators shown attached on the machine.



light and heavy side milling cuts. Precision boring is shown in the last two photographs. Boring jobs are one of the several variations in work possible on a milling machine. These jobs are done on a Knight Vertical Miller, a machine well adapted for this class of work. A coolant flows through the flexible pipe shown near the spindle on the cuts.

It is noticed that the work is held without using a special milling fixture. The pieces being milled rest on the surface of the milling table and universal clamping units are fitted in the T-slots of the table. This method is excellent when milling only a few parts, but for high production of parts it is best to have a fixture body under the work to prevent wearing the table surface.

The last essential for boring accurate holes on a vertical miller is the equipment used for quickly and accurately locating one hole from another. Dial indicator bars are mounted on both the longitudinal and transverse table movements as seen in Fig. 96. A large, easy to read dial, graduated to .0001″, is mounted at one end of each bar. A stop fitted onto the table and another on the saddle travel beside each bar. Between the stop and the indicator, end bars and inside micrometers are placed to measure the exact spacings between holes before boring.

Joseph Ridder,
Chief Roll Engineer
The Yoder Company

ROLL FORMING OF STRIP METALS

ROLL forming is a process of continuously feeding metal strip between male and female roller dies, which are arranged in graduated steps to permit the strip to roll out the other end of the machine in straight or curved form. When the angle of forming is acute, roll forming will not tear the metal because it is done in steps. As a matter of fact, roll forming makes the shape stronger in the corners because the grain structure is moved closer together.

Proper gauge metals should be used as much as possible. Roll forming machines are primarily used for forming, although some slight sizing and straightening operations are performed.

A Large Variety May Be Roll Formed

A large variety of metals and alloys can be roll formed. Steel, brass, bronze, zinc, aluminum and high strength alloys can be efficiently handled by the Yoder roll forming machines. A combination of two metals, used to secure economy as well as attractiveness, may be roll formed at the same time. Intricate shapes such as tubing, mouldings, angles and channels can be produced. Length of the formed shape is limited only by the length of the strip metal and the facilities for handling the finished shape.

When roll formed shapes are used, fewer joints in the finished product result and production is thus accelerated. Production costs are reduced since machining operations may be combined with roll forming operations. In this way many parts can be obtained more cheaply and rapidly in some cases than by machining alone. There is no scrap where strip metal is fed directly through roller dies. Conservation of strategic metals is accomplished due to the fact that baser metals may be used when roll formed.

Cleanliness an Important Factor

An important factor in the forming of various metals is cleanliness. Aluminum, in particular, is damaged very easily by particles of abrasive matter. Care should be taken to prevent the ingress of foreign matter into the operation and in contact with the tools or materials by way of lubricants and surrounding air. Although roll forming does not need coolants or lubricants to a great degree, there may be times when a coolant would help to remove the results of excessive friction.

The power needed to roll form depends upon the angle of the shape, that is, the number of bends, the temper of the metals being formed and the number of impressions or rolls used in the forming operation. Speed has less effect on the power consumption than other conditions. However, the higher the speed, proportionately less power is used. Production speeds are formed to a large extent by the materials being formed. Speeds of from 100 to 200 fpm are common.

How Many Rolls Needed

The question of "how many rolls should be used in forming a shape" is of paramount importance. The best rule for an inexperienced designer to follow is that "seldom too many rolls are used to form a section." A complete new set of rollers is not always needed for a roll form job. Rolls for a large variety of shapes will be accumulated over a period of time and there will be cases where some rolls already in existence can be used or supplemented to complete a job satisfactorily.

Auxiliary equipment such as coil boxes out of which strip is easily fed into the rolls without over-running or tangling should be used. Fed in straight, rolled straight and coming out straight —no extra straightening operation is needed.

TOOL TIPPING, METAL SPRAYING

CONSERVE WAR-IMPORTANT METALS

UNDER war conditions no plant or machine shop owner can think only of his own interest when dealing with worn out equipment. Obviously, he must make his action conserve available supplies of materials and labor for war production. This means not only avoiding the purchase of new machinery—assuming he can get it—but holding his consumption of new parts to the minimum, assuming he can obtain even the replacements.

Along with this he must keep his equipment going without interruptions, despite the greater wear and tear of operating constantly at maximum capacity, on a speeded up schedule.

So what does he do? The chances are he builds up the worn parts of his equipment by one of the several metal surfacing methods now proving so widely useful under war conditions.

Besides heavily reducing consumption of many scarce materials, metal surfacing processes stimulated by the war are minimizing the necessity for tying up large quantities of spare parts stocked by dealers and manufacturers.

But the new techniques are not confined to maintenance operations.

American manufacturers have long designed many articles better than necessary for the purpose. Besides their attempts to attain eye appeal and other sales features through over-abundant use of nickel and chromium and other alloy metals, they have often done only the most obvious things in limiting the use of special purpose materials to the point actually necessary for functioning of articles. A paint brush consisting only of bristles would, of course, be ridiculous—yet many articles have been made entirely of alloy steels when only a tip or surface required the relatively expensive and scarce metal. The manufacturer of the paint brush hardly could avoid making a handle of cheap wood, but the maker of a drill or punch extravagantly consumed three pounds of high grade tool steel to provide one ounce of point or edge.

The war is changing much of that, with tool tipping and metal surfacing among the important means by which WPB, the armed services and manufacturers are working out more sensible specifications.

In addition to successfully modifying the design of new products, these methods are proving of big value in salvaging articles spoiled in manufacture. An axle, for example, may be machined .001" or more undersize. Such defective parts are an increasing problem today in view of the many new and inexperienced workers in war plants. Instead of discarding the axle, as was often done a few years ago, the part will be brought up to size by one of several alternative procedures which metallizing and plating afford.

There are three general methods of applying metal surfaces and the tool tipping process which is closely related to them. War Production Board orders limit the use of surfacing and tipping materials to essential types of equipment and products because of the scarcity of the alloying elements contained in such materials. Generally, they can be used only in orders for repairing or

processing of equipment and machinery carrying high priority ratings.

The first metal surfacing method—electroplating—has long been employed chiefly for ornamental or corrosion-resisting purposes.

But in the last war the AEF operated an electroplating plant in France for salvaging worn parts of machinery. The process later was developed by private industry. Chromium is the material usually plated by this method on wearing surfaces, such as shafts and bearings. It is harder than the hardest steel—highly resistant to abrasion. Cadmium, nickel, copper and zinc also are used for the special purposes for which they are adapted. (Hard Chrome Plating Aids War Effort, The TOOL & DIE Journal, December '42, pag 50.)

Some of the advantages of electroplating over other metal surfacing methods are: more accurate control over the thickness of the metal coating, this varying from .0001" to .005" and more; no warping or distortion, since heat is not used; ease of application in inacessible portions of the article and to curved and round surfaces; retention of the shape of the parts processed; and the fact that electroplating is the only way chromium can be applied.

On the other hand, there are disadvantages. Where a large amount of material is to be applied, electroplating will take too long—the extremely hard surface of chromium, the material most frequently used, is difficult to drill and otherwise work with—and its brittle characteristics rule out the employment of this material when the plated equipment will be subject to considerable shock. Also, due to the size of equipment used, electroplating cannot be done in the customer's manufacturing plant or machine shop, as is often possible with welding or spraying.

Industrial electroplating abounds in interesting case histories. A toolmaker spends several weeks making a die. When it is almost completed a slip occurs and the die becomes undersize in some respect. Without electroplating or some other surfacing process the toolmaker would reject the die and make a new one, consuming several additional weeks and correspondingly retarding production. But by building up the die by plating he can correct his error overnight.

A gear forging is rough ground and hardened, but when ready for the final grinding it is found that in the rough grinding too much material has been removed and there is not enough remaining to clean up. A plating job will restore the undersize part and make it possible to regrind to correct size.

A shaft becomes worn to such an extent that a machine cannot be operated. It is part of a production line and a breakdown will stop the entire line until the shaft can be replaced. The industrial electroplating man rebuilds the shaft to proper size with chromium and the machine goes back into operation with a minimum loss of time. As another advantage the shaft probably will have a longer life and give better service because the new surfacing is harder and tougher than the original metal.

Uncle Sam is having his share of profitable experiences too. About a year ago a Government arsenal had 80 breech mechanism hinge pins left over from the last war which it thought might be utilized in some modern guns it was turning out. The pins were valuable alloy steel and to duplicate them would cost from $80 to $100 apiece, aside from the scarcity of the material and the time required for turning out a special order.

The pins, however, when fitted into the breech of the new guns were about .030" undersize, which made them unusable. An industrial electroplating expert asked permission to salvage the old hinge pins by plating with nickel, and when allowed to go ahead, built them up to the required size. The cost was about 5 percent of the price of new pins. The time and material saved were priceless.

In the manufacture of new products the extent of applications is approaching the scope of maintenance operations. They range from the plating of gages used in maintaining specified tolerances on war equipment to chromium plating of heavy equipment to lengthen its life.

Spraying or metallizing is the second

(Continued on Page 142)

Eric N. Simon
Edgar Allen Co.
Sheffield, England

SPECIAL DRILL DESIGNS TO MEET INDIVIDUAL REQUIREMENTS

THERE has been little development in twist drill design over the last ten or twenty years. The quality of high speed steel employed is better; the hardening treatment has improved; and there have been certain refinements in finish. Moreover, in Britain at all events, most twist drills are being made today by butt welding a high speed steel cutting portion to an oil toughened steel shank, thus producing a drill "right at both ends", since the oil-toughened steel is better suited to resist the twisting stresses encountered in drilling than is the much more brittle high speed cutting steel. The result has been a marked diminution in drill breakages in Britain's engineering shops.

This refers solely to the "general purpose" drill, working on the normal materials of daily shop practice. Certain special drills have of course been invented during the period mentioned, particularly the special drill for manganese steel (11-14 percent manganese).

Orthodox Design Out of Date

Britain's engineers are now coming to the conclusion that orthodox twist drill design is hampering progress, both in regard to penetration per revolution and revolutions per minute, in view of the possibilities afforded by the latest high speed steels. They feel that the present design detracts from the ability of drills made from the highest classes of high speed steel to withstand heavier feeds and faster peripheral speeds.

Drilling machine makers annually increase the power and strength of their products. It is always easier, for example, to install a larger motor than to manufacture a steel that will stand up at the working end. In consequence, the twist drill rapidly becomes the weak link in the chain.

For a given design of drill, there is little, if any, difference between the feed per revolution that can be employed with a carbon steel twist drill and that possible with a high speed steel drill. Logically, therefore, the twist drill made from the best high speed steel can only justify its extra cost by either lasting longer between grinds, or by effecting a greater penetration per minute by increased peripheral speeds. In the attempt to achieve increased speeds, conditions sooner or later cause failure by breakage.

Causes Cost to Rise

A small percentage of such failures, combined with the high first cost of super-high-speed steel drills, causes the cost per hole to rise rapidly, and the user is driven back to the ordinary run of lower quality high speed steel drills. In Britain drills made from steels of super-high-speed steel type, i.e., those containing more than 18 percent tungsten or substitute steels of correspond-

Fig. 1—Special design of super-high-speed steel British drill, designed for drilling specially hard materials.

ing types, are not popular for general purpose drilling, because of the failures experienced.

To be successful for general purpose drilling, a twist drill must possess a measure of elasticity, which is lacking in the super-high-speed steels. If drills of these high quality steels are to be employed, design must be changed to minimize this need for elasticity. In general, this need decreases as the sturdiness of the drill form increases.

Now that the butt welding of twist drills is accepted, designs become feasible that would have been wasteful a few years previously. Britain's drill makers consider that maximum efficiency is attained by using what may be termed the "single purpose" drill, not for general jobbing work, but for quantity production on normal materials.

Swing-Over to 18 Percent Tungsten

The higher qualities of super-high-speed steel are not suited to the general run of jobbing drills, and those of 14 percent tungsten steel or its substitutes are still being used extensively in their manufacture, though in British shops there has recently been a marked swing over to 18 percent tungsten steel or its substitutes.

Many operations call for drills with a specially tough temper to prevent an unduly high percentage of breakages. The super-high-speed drill is useless for such jobs, as some of the cutting ef-

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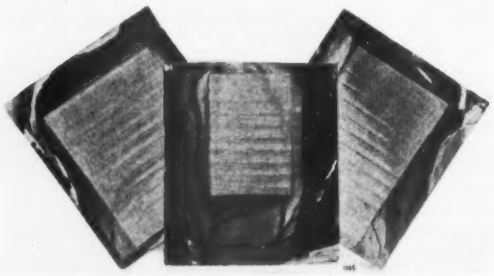

Fig. 2—Austenitic chromium nickel stainless steel sheets 26 in. x 18 in. x 20 G, bright polished and drilled with 14 G dia. holes with drills of shortened flute length.

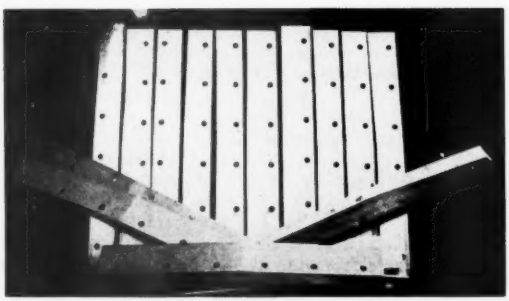

Fig. 3—Austenitic chromium nickel stainless steel plates, 42 in. long x 5⅞ in. wide x ⅜ in. thick, drilled and bent, holes drilled with shortened drills.

BROACHING AND HOBBING DUAL LEAD ANGLES

AN unusual example of production possibilities inherent in combining interlocking broaching and hobbing operations is represented by the combustion starter subassembly shown in Fig. 1. Mechanisms of this general type are used for starting engines in racing cars, aircraft, yachts, etc. The subassembly consists of three numbers: (1) an inner shaft with a spiral spline on one end; (2) a middle member into which the shaft is fitted and on the outside of which a hub (3) is mounted.

To obtain freedom of longitudinal movement of the three mating parts for the entire length of travel, it is important that the specified helix angles of both internal and external splines be accurately maintained. The tooth form or contours and spacing of the splines must also be accurately reproduced, while close concentricity between the inner and outer splines of the middle member is necessary.

The broaching operations are performed on Colonial horizontal broaching machines equipped with helical drive attachments and broad guide heads and lead bars to assure both conformance to the desired lead angle and concentricity (Fig. 2). In general, the set up is similar to that used for broaching the internal splines of automobile transmission gears.

The inner member or shaft is turned from molybdenum steel bar stock and consists of a hollow shaft on which a straight spline is cut on one end for attachment to a clutch. On the opposite end a helical spline with a counterclockwise twist is hobbed. The helix angle in the type shown is approximately 35°, providing a lead equivalent to one revolution of the shaft for about 8″ of travel. Limits on the external diameters of the finished spline must be within plus or minus .0025″.

The internal spline on the middle member is broached in two passes. Rather than performing both roughing and finishing in a single pass, different broaches—a roughing broach and a shorter finishing broach—are used for each pass. The finishing broach can be made sufficiently long to provide for accurately finishing to specified size. Broach cost is also reduced since wear on the roughing broach does not affect the finishing operation.

The outside of the middle member is hobbed to produce ten splines, these having a clockwise helix of the same lead as the inner spline. Since this part is more than 5″ long and the lead angle is about one turn in 8″, approximately 1¼ turns are provided by sliding the inner members out of engagement. Limits on the outside diameter of the external spline are plus or minus .0025″.

Fig. 1 (Right)—Assembly of combustion starters with mating internal-external spiral splines produced by broaching and hobbing

Fig. 2 (Bottom Right)—Spiral broaching of internal splines with high helix angle.

Fig. 3 (Bottom Left)—Parts comprising subassembly shown before and after broaching and hobbing with center member sectional to show helical internal splines.

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WHEN we first announced the Por-os-way precision grinding wheel about a year ago, we were ready with a plant far exceeding our previous one. But two things have happened. First, the war. Then Por-os-way, making good its promise to increase grinding production 2 to 5 times per man per machine, has literally sky-rocketed in demand. Hundreds want to prove Por-os-way can up production 2 to 5 times for them, want to see how its cool action practically eliminates burning, how it takes cuts double or more than previous wheels and grinds in fewer passes, how it can cut faster, producing an even *better finish using a finer grain*, why it resists loading, holds its corner, reduces the number of dressings necessary.

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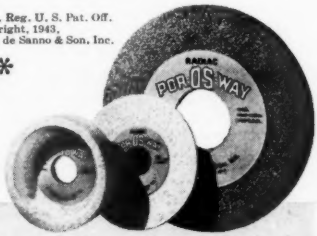

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PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES

PLANING and SHAPING TECHNIQUE

PLANING and SHAPING TECHNIQUE

PLANERS and shapers are used to rough and finish machine flat surfaces by means of tools with single point cutting edges. Such surfaces are required on many different castings and machine parts. Planing can be more closely defined as the removal of material from plain surfaces with the help of cutting tools fixed in a machine comprising a bed, a traveling table on which the work to be planed is carried, standard cross-slide tool-box and machine drive. Shaping has a certain similarity to planing but differs from it in the following respects. Shaping is only carried out on small areas of metal, usually not above one foot in length and usually much less. Shaping can also be easily adapted to the cutting of convex or concave surfaces. In shaping convex parts, the work is threaded on an arbor which is caused to revolve at a low speed. Concave surfaces are shaped by using a toolholder which has a worm or helical gear on the upper portion of the tool box. By this arrangement the tool is made to revolve slowly through the arc of a circle.

The Planing Process

The work or part to be planed is fastened to the planer table that has a reciprocating movement. The length of the stroke, which is adjustable, should be a little longer than the surface to be planed. While the tool remains stationary, the work traverses beneath it accomplishing the planing operation. The table then returns to its original position and the tool is given a lateral feeding movement before the next cutting stroke begins. Planing operations are usually performed with first a roughing cut and secondly a finishing cut. Since the object of the roughing cut is to remove surplus metal, the roughing cut may be determined by the total amount that must be removed. As a general rule, only one roughing cut is necessary. The roughness will vary according to the feed per cut and the shape of the tool. In taking finishing cuts, especially on cast iron, it is well to use a broad tool having a straight cutting edge. This operation is necessary to remove the ridges left in rough planing with a round nose tool. The cuts are comparatively light and usually a large feeding movement can be given. There are several different types of planers; however the majority are similar in operation. Figure 1 illustrates a typical open side planer while Fig. 2 illustrates a double-housing planer with four tool heads taking cuts simultaneously on a planer bed.

The Shaping Process

The shaper is used for facing surfaces, notching, keyseating and the production of flat surfaces on small parts. It is essentially a toolroom machine. Typical illustrations of a modern shaper at work are shown in Figs. 3, 4 and 5. The action of a shaper is quite different from a planer. In fact, its operation is just the reverse, since the tool moves across the work which remains stationary except for a slight feeding movement on each stroke. The ram operates in ways at the top of the column and the toolholding head is fastened to the front of this ram. An angular surface may be shaped by setting the tool head at whatever angle is required. The stroke of the ram and tool is adjusted to suit the length of the work surface.

Slotting Process

Vertical shapers or slotters are so constructed that the ram reciprocates vertically. They are used extensively for keyseating, notching, facing and die making. The primary difference between a vertical and a horizontal shaper is the fact that the slotter tools have the cutting face on the end of the shank.

Typical Shaping Operation

The flexibility of a vertical shaper is

Fig. 1

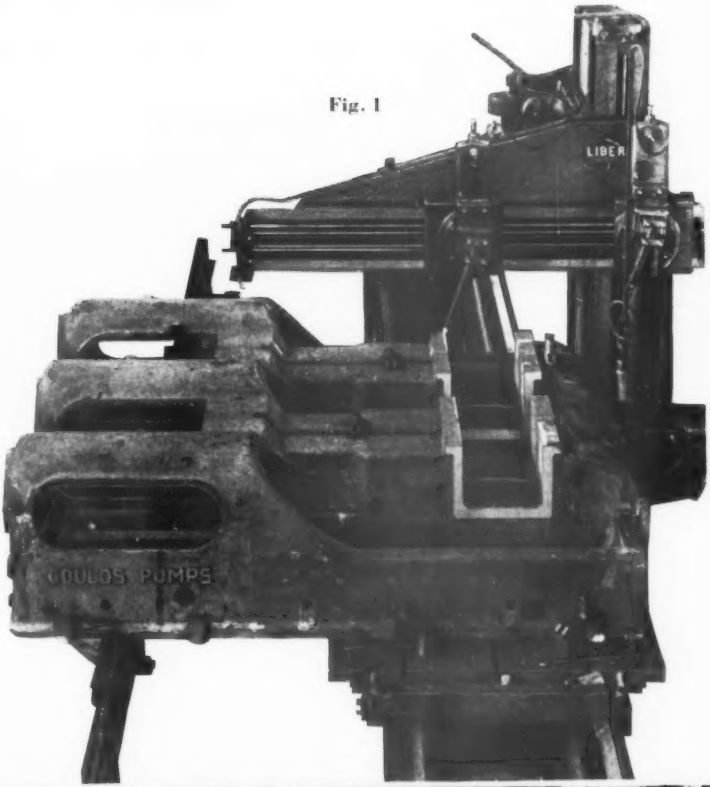


Fig. 2

well illustrated in Figs. 6, 7 and 8. This application shows a roughing and finishing operation on two 2½" x ¾" keyways in cylinder barrels used in the hydraulic control of 8" guns. These barrels were forgings about 21½" diameter and 10⅜" high of SAE 4615 steel, normalized and annealed. The operation was to produce a smooth finish on the bottom of the keyway to a limit of .002" from the hole center. The sides were to be smooth and the width of the keyway held to within .002" overall and central with the hole. One roughing tool was used. For finishing, two different tools were used, one for the bottom and another with two tool bits for the sides. Although the cutting tools were made from Stellite, it was found economical to resharpen them after every ten pieces. The roughing tool was similar to the bottoming finishing tool illustrated in Fig. 7 except that its edge was straight. It can be seen that the bottoming tool has a relieved portion in the middle to prevent digging in. It can also be seen that this tool has been given additional support by means of a rib welded to the toolholder.

A double bit tool was used in finishing both sides of the keyway. Here again it is noted that the cutting edge of the tool is relatively narrow to provide a good finish. In general, the longer the toolholder the smaller the cutting edge of the tool must be in order to obtain smoothness and accuracy. The shaper was set for a stroke of 8". Roughing was at 19 strokes per minute with a feed of .012" per stroke. The finishing speed was 31 strokes per minute and a .002" feed per stroke.

Holding Workpiece

It is important that the workpiece be held securely and solidly while it is machined. It is equally obvious that the work must not spring out of shape during the cut. All efforts to grind and set tools properly are a total loss if the work is not properly supported and secure.

Due to the size of a planer and the size of work mounted upon it, more time is required for setting up the planer than is required for other machines. Setting up often requires more time than the actual machining operation. Considerable skill is usually required in clamping work. All planer tables or platens are constructed with T-slots and reamed holes on their surfaces to provide means for holding and clamping down parts that are to be planed. A heavy-duty vise held by bolts is suitable for small objects. For light cuts on long thin parts, a magnetic chuck can be used with stop pins. Most work is held directly to the table and a large number of clamps, stop pins and holding devices have been developed for this purpose. The work first must be held securely to prevent its being moved by the thrust of the cut. It should not, however, have so much clamping pressure that it is sprung out of shape. It is also important to place the work in a position that the surfaces requiring planing may be finished in the right relation with one another. Usually the forging or casting is clamped directly to the platen but in many cases

Fig. 3

chucks or special fixtures are used.

When castings or forgings are set up on the planer for taking the first cut, usually the side that is clamped against the platen is rough and uneven, so that it bears on a few high spots. Assume that a casting does not touch the platen at the ends where the clamping is to be. If the clamps are tightened without supporting the work at the unsupported ends, the entire casting is likely to be sprung out of shape more or less, depending on its rigidity; consequently the planed surface will not be true after the clamps are released because the casting then resumes its natural shape. To prevent inaccurate work from this cause, there should always be a good bearing just beneath the clamps which can be obtained by inserting pieces of sheet metal or even paper when the unevenness is slight. Thin copper or iron wedges are also used for "packing" under the clamps. It is good practice when accuracy is required and the work is not very rigid to release the clamps slightly before taking the finishing cut. This allows the part to spring back to its normal shape and the finished surface remains true after the clamps are removed.

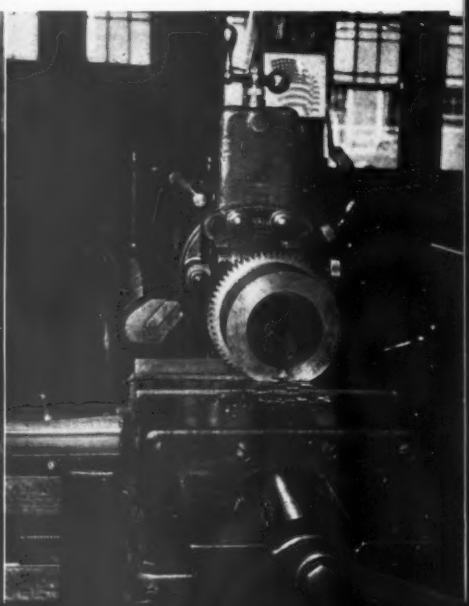
Very long castings or those which are rather frail but quite large and heavy sometimes bend by their own weight or are sprung out of shape by the pressure of the planing tool unless supported at the weak points. When setting such castings on the planer, small jacks form a very convenient means of support. These jacks, which are made in different heights, can be used in various ways for supporting work being planed. Hardwood blocks cut to the right lengths are also used as supports.

Internal Distortion

Even though a part may be securely fastened, it may be sprung out of shape by internal stresses in the casting itself. These stresses are caused by the unequal cooling of the casting in the foundry. The molten metal which first comes in contact with the walls of the mold cools first and in cooling contracts and becomes solid while the interior is still molten. The resulting stresses will act in opposite directions and when a cut is taken, the internal stress is relieved causing a slight distortion on the planed surface. This is one important reason for castings being rough planed before

Fig. 4

Fig. 5



the finishing cut is taken. When accuracy is required, it is well to rough plane the casting and then allow it to "season" for several weeks before taking the finishing cut.

The majority of shaper work is held in a vise. The operator should always check the clamping surfaces to be sure they are clean and free from nicks and burs. He should then tap the work with a soft faced hammer to seat it solidly. Sometimes it is necessary to shim rough castings to provide ample support. In shaper work it is always a good idea to locate the vise as near as possible to the back edge of the table. The vise jaws should be set in alignment with the stroke of the ram or with the cross feed of the table and the work clamped with the true side against the solid jaw. A round holddown may be used on the other side of the work against the movable jaw. The holddowns can be set by feeling the work as it seats itself and should be made of some soft material such as copper. The workpiece may also be clamped on the table by special fixtures and rough castings should be shimmed to have ample support. Methods of clamping various types of shaping operations are shown in Fig. 9.

Sometimes a surface gage is necessary when setting up work as is illustrated in Fig. 10. Also illustrated is a method for setting up an indicator in the tool post when extreme accuracy is required. A precision square is helpful in setting up work on the table.

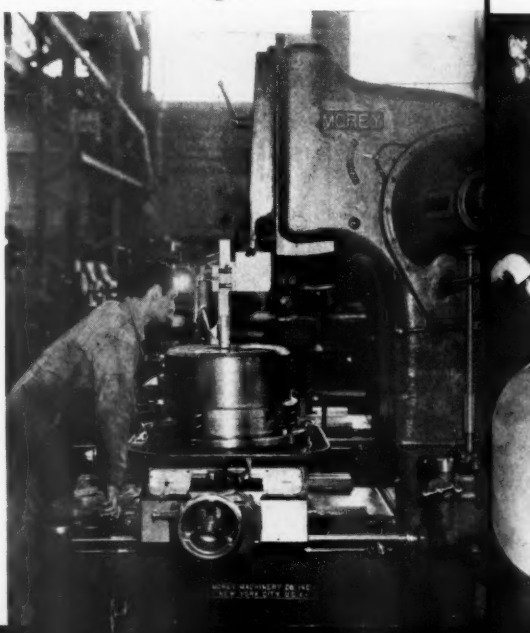
Cutting Tools

Regardless of the size of the machine tool used or its distinguishing or exclusive features, the small cutting tool produced from high speed tool steel in the tool room or purchased from a manufacturer is responsible for the accuracy and productive ability of these machines. There are innumerable styles of tools used. Each is designed for a particular type job application.

Planer Tools

The G. A. Gray Company has prepared the twelve suggested styles of tool points for planers as shown in Figure 13. A round nose roughing tool for cast iron at No. 1 is used for feeding from right to left or from left to right. If the entire surface is to be the same height, the tool might be run from left to right and then reversed for the finishing cut. Since the tool has no side rake, the depth of cut should not be more than ½". No. 2 is a right-hand round nose roughing tool and is used primarily on planers with two rail heads. They are particularly useful on roughing cuts in cast iron. Number 3 is a left-hand round nose roughing tool similar to No. 2. It, however, is fed from left to right and is used only on cast iron. Number 4 is a right-hand round nose roughing tool for steel. The angle is decreased to 4° and is not suitable for cast iron and if used for that purpose will pull-in and cause chatter. Number 5 is similar to No. 4 except that it is fed from left to right. If a considerable amount of stock is to be removed with either tools, a deep cut

Fig. 6



with a heavy feed and slow speed should be used. Number 6 is a square nose roughing tool for cast iron. It is used wherever a sharp corner is necessary. This tool can also be used for straightening or heavy finishing cuts when a fine finish is required (depth of cut .004" to .005").

Number 7 is a general purpose tool for straightening and finishing cuts on cast iron. It is a good idea to have several different widths from ⅜" to 1". A coarse feed may be used; however it is important to have the cutting edge of the tool exactly parallel to the work surface or the corner of the tool will dig in. Number 8 shows a "goose-neck" tool for finishing flat surfaces on any metal. It should be used in combination with a very shallow cut and coarse feed. After grinding, cutting edge of tool should be finished with an oil stone by hand to remove burs and leave a straight edge. A slender construction of the "goose-neck" gives a spring action which eliminates chatter as the tool passes over the work. Number 9 illustrates a dovetail end-cutting roughing tool for cast iron. A corner is rounded off so as to avoid break-down in taking the roughing cut. This tool may be fed either downward or from right to left. Number 10 shows a companion tool which is fed from left to right. Numbers 11 and 12 are left and right-hand tools used to clean out corners after most of the metal has been removed by tools shown in Numbers 9 and 10. This tool, however, is not as well suited for general dovetail work as Number 9 because the sharp corners break down.

Shaper Tools

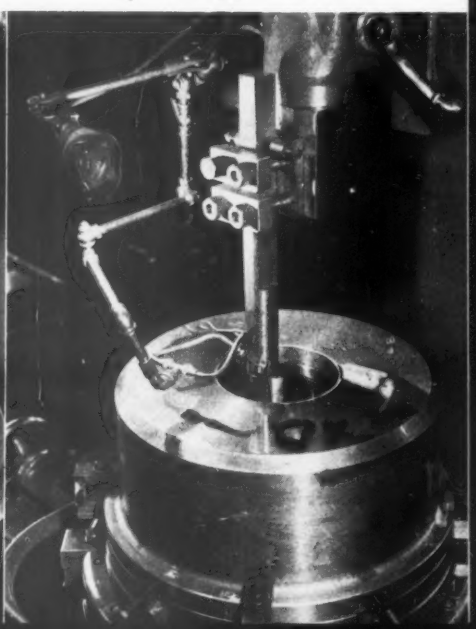
Recommended cutting tools for use on shapers are shown in Figures 14, 15 and 16. It will be noted that these tools are like those used in planer work. Shaper and planer tools are similar to those used in lathe work. They are, however, usually set perpendicular to the work and for this reason the heel clearance is much less than those described in Turning Technique (January 1943 issue). Side rake should be provided for because this promotes shearing action, giving a smooth finish, and a side clearance is necessary to prevent drag on the tool as a result of rubbing along the work.

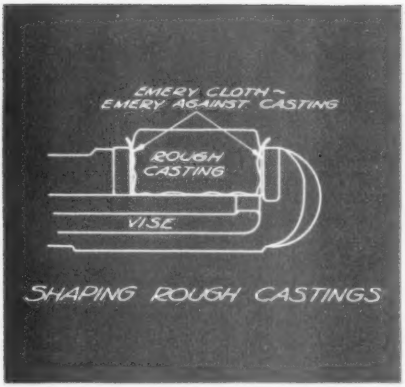
Tool Grinding

As soon as the cutting tool shows any

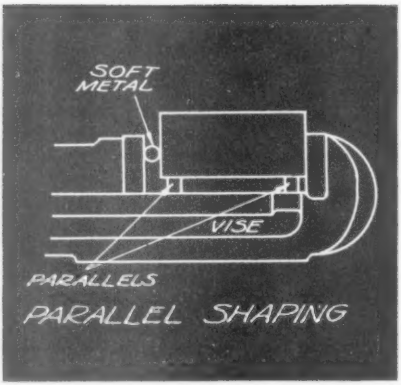
Fig. 7

Fig. 8

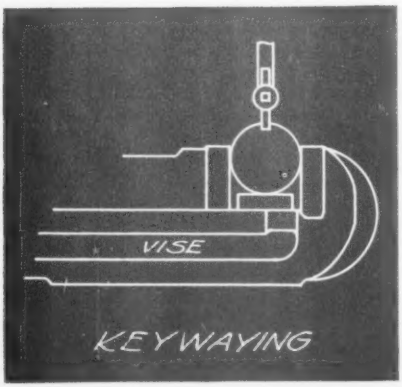



EMERY CLOTH ~
EMERY AGAINST CASTING
ROUGH CASTING
VISE
SHAPING ROUGH CASTINGS

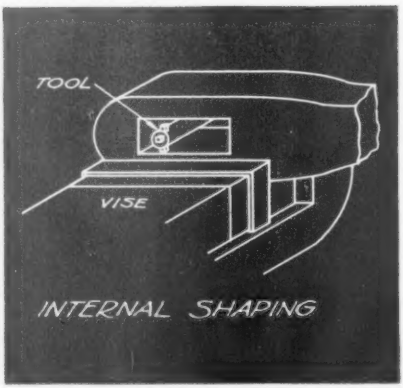
A


SOFT METAL
VISE
PARALLELS
PARALLEL SHAPING

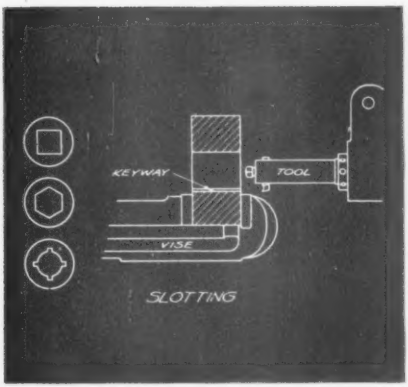
B


VISE
KEYWAYING

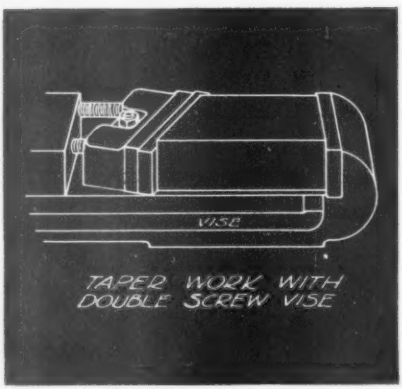
C


TOOL
VISE
INTERNAL SHAPING

D


KEYWAY
TOOL
VISE
SLOTTING

E


VISE
TAPER WORK WITH
DOUBLE SCREW VISE

F

Fig. 9

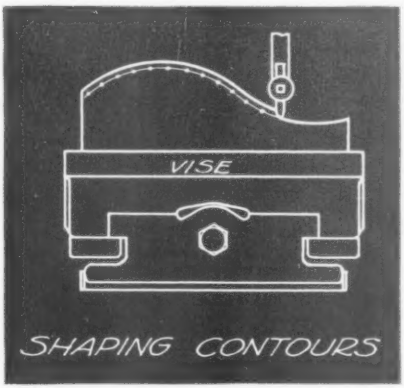
sign of dullness, it should be ground and then the edges should be stoned to obtain a smoother, longer life edge.

Tool Holding

The smallest possible overhang should be used and the clapper box should be set so that the top slants slightly away from the cutting edge of the tool. This permits the tools to swing away from the work on the back stroke and protects the tip from unnecessary wear. The tools should be inserted in the tool holders, leaving ½" or so extending. If forged tools are used, they should extend from the clamping bars far enough to perform the cutting operation without allowing the tool head to touch the work. In shaping or planing dovetails, set the slide to the angle of the dovetails.

Cutting Speeds and Feeds

As in other machining techniques the proper speed and feed is important. The cutting speed for planing usually varies from 20 to 80 feet per minute whereas the return speed of the table is from two to four times as great. Three times the cutting speed is a fair average. Some



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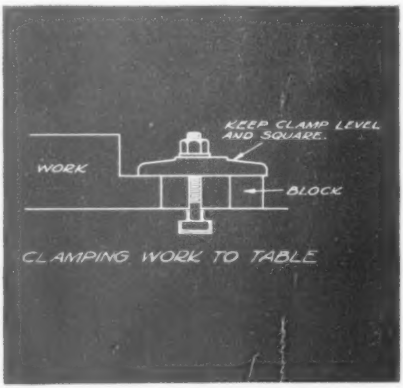

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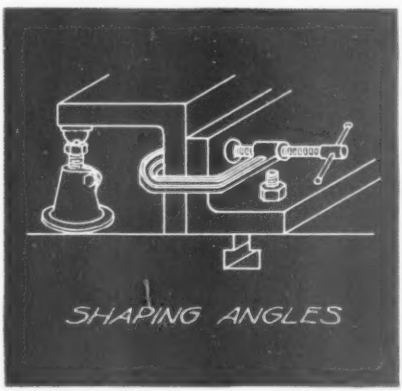

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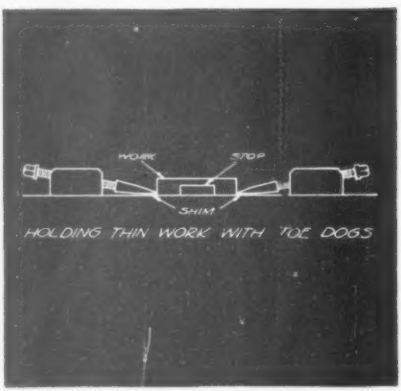

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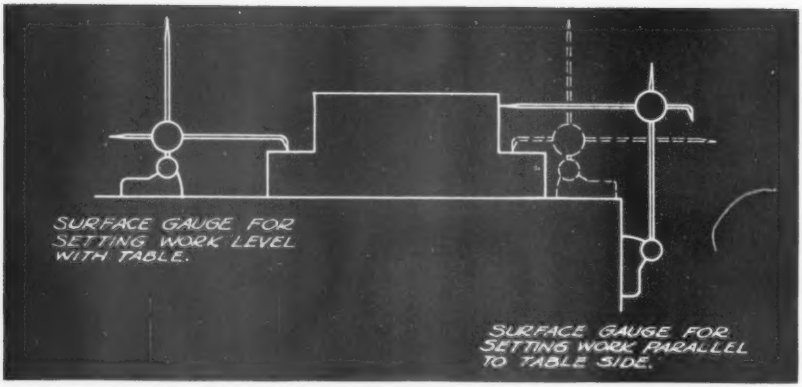


Fig. 10

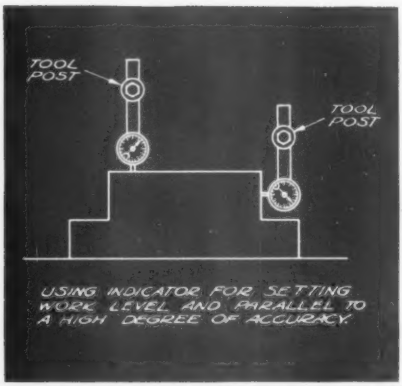


Fig. 11

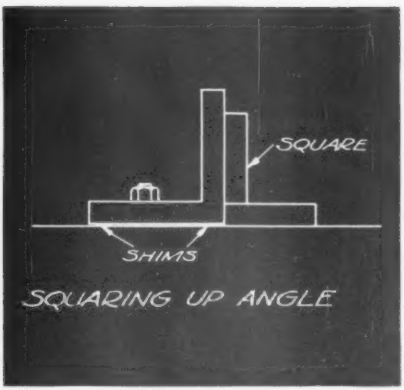
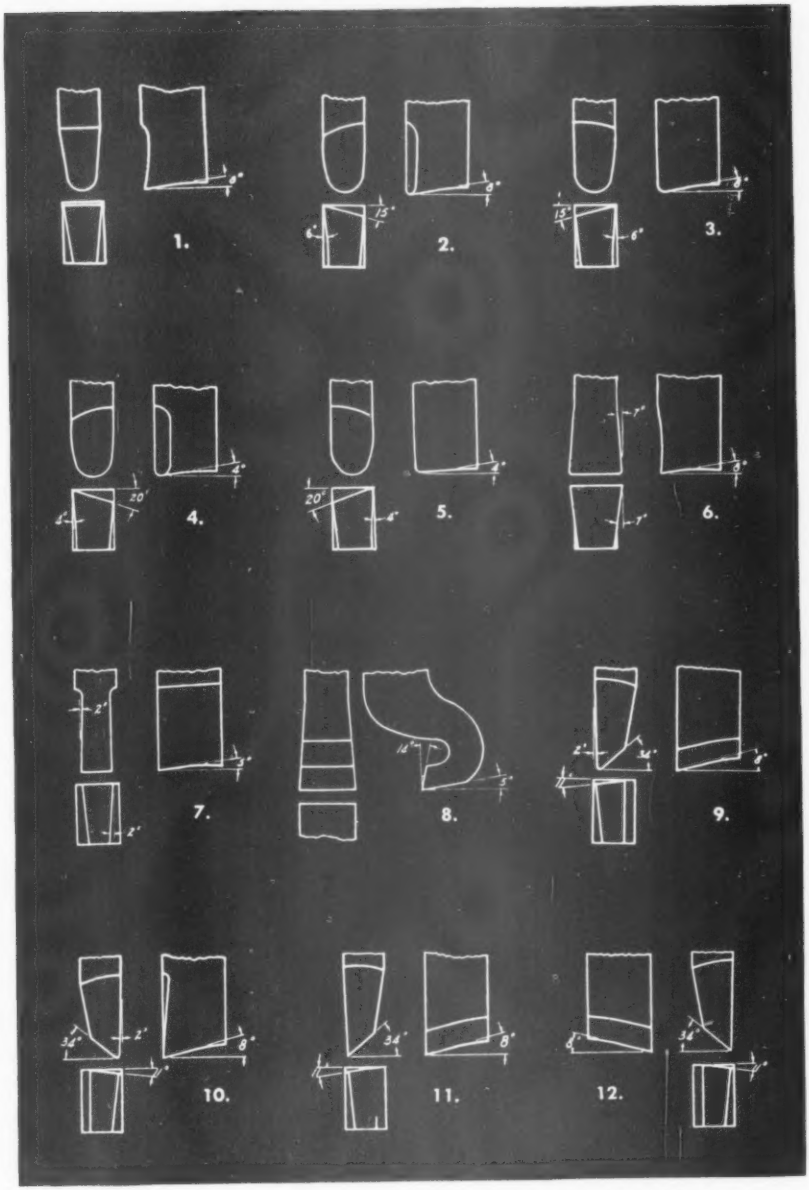


Fig. 12

planers are built with speeds up to 200 feet per minute. When a planer has a variable speed drive, the cutting speed should not only be governed by the nature of the material to be planed, but also by other conditions. For instance, in planing a heavy cast iron piece of considerable hardness, if there is plenty of stock to remove, the planer should run fairly slow on the cutting stroke and take heavy cuts. A tool will stand heavy cuts at a low speed better than when running at a comparatively high speed with light cuts. Moreover, since the table and work travel a smaller total distance for the removal of a given quantity of stock, less power is required merely to move the table with its load. The return speed, in this case, should be moderate because the rapid starting and moving of a heavy load subjects the planer driving mechanism to severe strains.

When the work is heavy and there is comparatively little stock to remove, the cutting speed should be as high as the tool will stand but the return speed should be kept within moderate limits. When the work is of light weight, but stocky, and considerable metal has to be removed, the cutting speed should be moderate but the return speed may be high. When the work is light and there is little stock to be removed, both the cutting and return speeds may be comparatively high. In order to secure the best results, there are other factors

TYPICAL PLANER TOOLS



G. A. Gray Company

Fig. 13

which should be considered. For instance, it is of little benefit to have high return speed on a short stroke because this simply results in wearing the planer without accomplishing anything. In planing steel, a fairly high cutting speed may be used even if there is considerable metal to be removed because most high speed steels work better at a high speed on steel than on cast iron. When brass is to be planed, high cutting speeds may be used, but with some bronze a low cutting speed is necessary in order to avoid tearing the work.

The planer tool is fed usually at the end of the non-cutting stroke. Feeds range from 0.005" to ⅜" for roughing and from ⅛" to 1½" for finishing. The depth of cut ranges up to 1¼" or even greater. Finishing cuts usually are very shallow with very large feeds. Most finishing tools have a flat, ½" to 1½" wide, and the feed is such as to allow a small overlap. Recommended planing speeds are shown in Table I.

Most shapers are very rugged machines and are capable of heavy cuts and feeds if the work is held firmly. Usually the student has a tendency to operate the machine with too light feeds and speeds. Cutting speed depends upon several things: 1. The kind of metal being cut—hard metals require slow speed; 2. The size of the cut—a light cut can be taken at a faster speed than a heavy cut; 3. The kind of cutting tool used—a high-speed tool can be used at double the speed of a carbon steel tool; 4. Shape of the material—large blocks of steel or cast iron can be cut with a coarser speed than frail castings of aluminum or cast iron. It is impossible to establish a rule for depth of cut or amount of feed. It is usually safe, however, to use as much feed as possible without producing a rough surface. The process of determining the cutting speed of a shaper is more difficult than for the lathe, drill press or milling machine. Since the motion is reciprocating, it is necessary to consider

Cutting Tools Recommended for Cast Iron

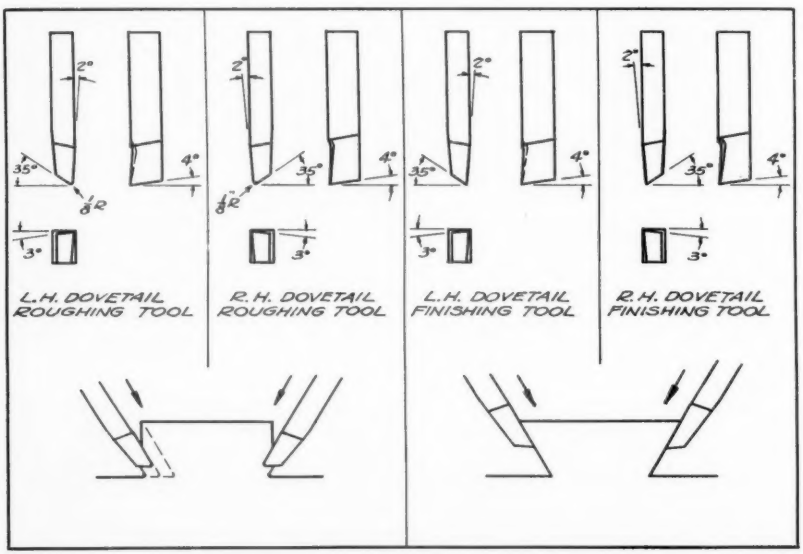


Fig. 14

Cutting Tools Recommended for Steel

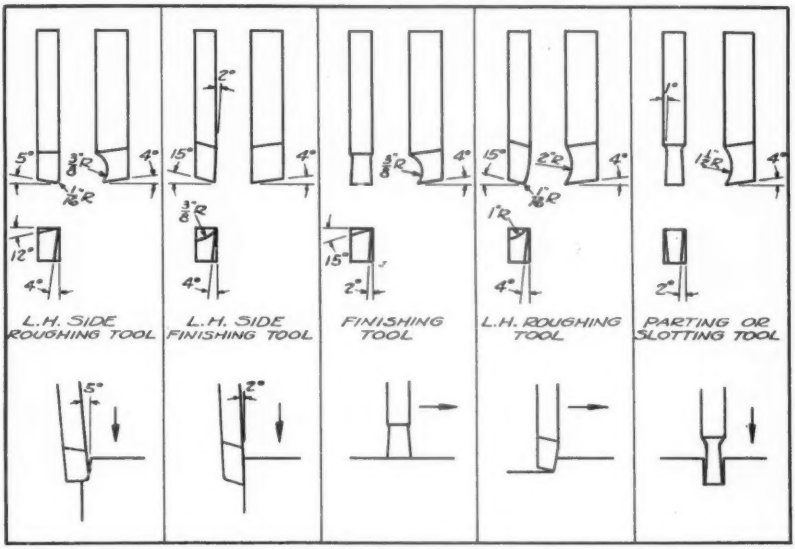


Fig. 15

Cutting Tools Recommended for Cast Iron

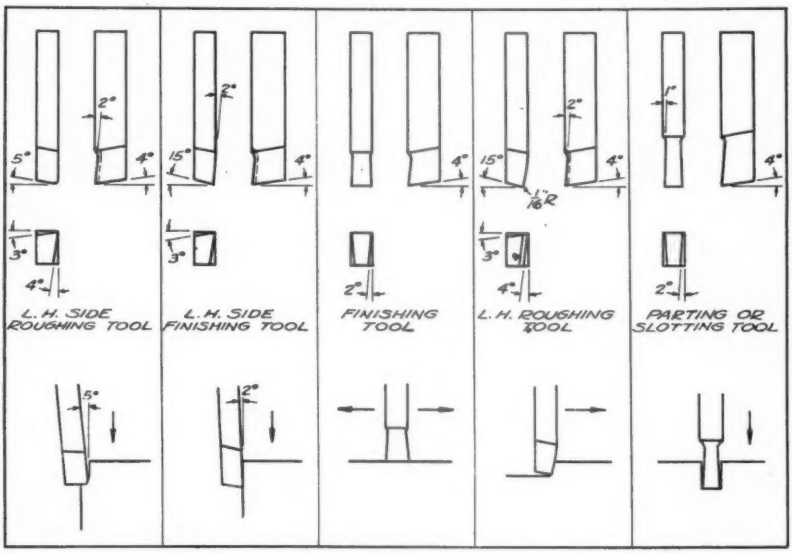
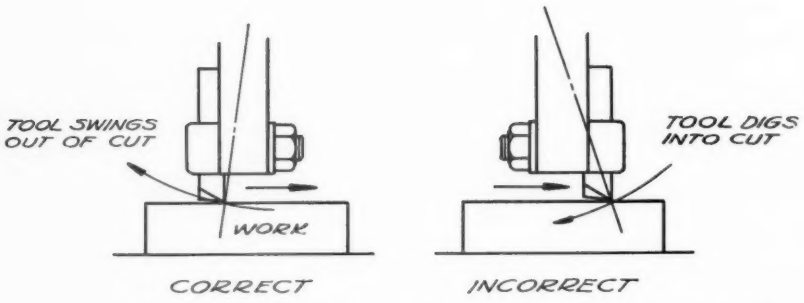


Fig. 16

IF TOOL CHATTERS — LOOK FOR



CORRECT & INCORRECT TOOL SETTINGS

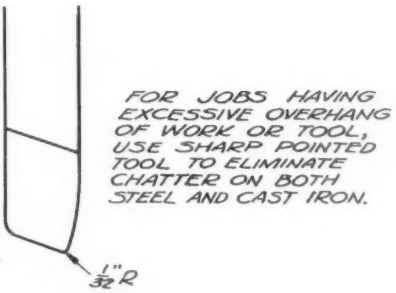
the number of strokes per minute and to take into account the ratio between the cutting stroke and the return stroke. In most shapers, it takes about 1½ times as long to make the cutting stroke as it does the return stroke. A complete cycle, however, consists of one cutting stroke.

Generally the shaper is operated too slowly. The suggested speeds and feeds shown in Table II will prove helpful. Wherever accuracy is an important factor, a roughing cut should be taken first. On steel .010" to .015" should be left for finishing. On cast iron leave .005" to .010".

TABLE I

Material	Type of Work	Speed in Ft. Per Min.	Feed in In.
Aluminum	General	60–100	1/32–1/20
Brass	General	50–90	1/20–1/16
Bronze	General	50–90	1/20–1/16
Cast Iron	Roughing	40–60	1/8–1/4
	Finishing	20–40	1/4–1/2
Gun-Metal	General	50–90	1/20–1/16
Mild Steel	Roughing	30–65	1/16–3/16
	Finishing	20–40	1/4–1
Steel Castings	Roughing	30–45	1/16
	Finishing	20–40	1/32–3/16
Wrought Iron	Roughing	30–50	1/16–3/16
	Finishing	20–40	1/4–1

1. **IMPROPER CLAMPING & SETTING OF TOOL**
2. **IMPROPERLY GROUND TOOL**
3. **IMPROPER CLAMPING OF WORK**
4. **IMPROPER ADJUSTMENT OF MACHINE**


FOR JOBS HAVING EXCESSIVE OVERHANG OF WORK OR TOOL, USE SHARP POINTED TOOL TO ELIMINATE CHATTER ON BOTH STEEL AND CAST IRON.
1/32 R

Important "Do's" and "Don'ts"

Both the planer and shaper should be kept clean and well lubricated. Chips should be cleared from the vise, clamps and table and any roughness due to previous machining operations should be ground or filed smooth. The workpiece should be bedded down by means of a soft metal hammer. It must never be hammered but only tapped into position. Excessively tight clamping of thin work must be avoided to eliminate possible distortion. If the cutting tool is being set to a completed surface, precautions should be taken to be sure that the tool block which holds the tool post and tool is firmly held. A thin tissue paper should be inserted between the cutting point and the tool gently lowered until it just holds the paper.

Whenever a planer or a shaper is started, be certain that the tool head and tool will clear the work. If the toolholder is rammed by work mounted on the table, it is likely to be thrown out of adjustment and it will be necessary to take a cut off the table to bring it into line. Adjustment of the stroke of the planer table necessitates loosening

TABLE II

SHAPER CUTTING SPEEDS

	CARBON STEEL TOOLS		HIGH SPEED STEEL TOOLS	
	Roughing	Finishing	Roughing	Finishing
Cast Iron	30	60	60	120
Mild Steel	25	50	50	100
Brass	75	150	150	300
Aluminum	75	150	150	300
Tool Steel	30	60	60	120

the tripping dogs. If the machine is started while the dogs are loose, the table may run off the rack and even off the bed. It is a difficult job to relocate the table when this happens. With shaper work it is necessary to see that the work is properly and securely held in place. It is not uncommon to have the tool dig-in and dump the work on the floor, in which case the operator may be injured. Position the work in such a way that the ram will not strike it. When the tool head is swung at an angle, the ram must be positioned to avoid having the tool head strike the ram ways on the backward stroke. Such accidents result in gear damage or springing of some part of the machine.

We are indebted to the following firms who provided illustrations and textual data for this special section:

Cincinnati Shaper Company
Liberty Planer Company
American Technical Society
G. A. Gray Company
Morey Machinery Company
Atlas Press Company
Automotive Maintenance Mach'y Company
Pratt and Whitney Company

REPRINTS AVAILABLE

The six articles thus far published in the Training for Victory section are:

***Grinding Technique**	**Turning Technique**
***Milling Technique**	**Drilling Technique**
Welding Technique	**Planer & Shaper Technique**

They have been reprinted to meet the tremendous demand from war production training classes, department heads, government officials and machine operators. The supply of Grinding Technique and Milling Technique is exhausted but the others are still obtainable for a small handling charge. When ordering reprints, please designate the number of copies of each article desired. Address requests to Reprint Division, THE TOOL & DIE JOURNAL, 2460 Fairmount Boulevard, Cleveland, Ohio.

**Supply of reprints exhausted.*

Plastics Prove Worth in Marine Bearings

Today's modern navy and maritime service have added further proof to the importance of plastics in war, according to H. H. Ashinger, author. Shown here are Plastic Bearings on a 7,000-ton liner.

By H. H. Ashinger
Westinghouse
Electric & Mfg. Co.

PLASTICS PROVE WORTH IN MARINE BEARINGS

DURING this period of intensive war production, many industries are faced with critical shortages of materials, particularly steel, copper, aluminum, bronze and tin. Some prominence has been given to plastics as a possible replacement for these critical metals.

The story of the origin and early development of synthetic laminated plastics forms a chapter in the history of electrical apparatus. The plastics materials now used for marine bearings, gears, piston rings and pump valves were first developed as electrical insulating materials and contributed much to the improvement of electrical generating and transmitting equipment.

In the early days, available insulating materials such as paper, cloth, fibre and mica had limitations of one kind or another. Mica, for example, was the best of these materials since it was inorganic and hence not seriously affected by heat or moisture. However, it was not strong mechanically and had to be reinforced by other materials such as paper and cloth. A distinct need existed for an insulating material with good mechanical as well as electrical strength.

About 1904, a process was invented by Haefley, a Swiss engineer, for the manufacture of a new material called Micarta. This material consisted of a series of layers or laminations of paper or fabric with or without mica bonded together with shellac under heat and pressure. The invention was purchased by Mr. George Westinghouse and was immediately employed in the manufacture of round insulating tubes by the simple process of rolling in successive turns on mandrels. This process was not successful in the manufacture of laminated plate or molded forms because of poor bond between layers.

In 1907, Dr. L. H. Baekeland invented a synthetic resin which was unique in that it could be first softened, then hardened under heat and pressure. Mr. Westinghouse saw the possibility of its use as a binder in laminated plastics and particularly for making electrical insulating plate. The principal ingredients of the new synthetic resin were phenol, a by-product of coke manufacture or petroleum distillation, and formaldehyde, a by-product of wood alcohol manufacture.

To make good plate, layers of paper or fabric are impregnated with liquid resin and dried. The stack is then placed between the platens of a hydraulic press under high temperature and pressure. Under these conditions, the final chemical reaction called polymerization occurs, binding the fibrous material into a

This micarta stern bearing had a total wear of .045″ after 4 years continuous service.

new homogeneous composition.

Up to 1914, little thought was given to the use of synthetic resin bonded plastics plate for other than insulating purposes. At that time, an engineer was troubled by the noise in the gears of an automobile lighting generator. To eliminate the noise, rawhide and fibre gears were tried unsuccessfully. In a search for something better, the new plastics was used with very encouraging results. Its high strength, light weight and quietness in operation have since that time made this plastics a most practical material for many gear applications.

More recently a wide diversity of raw materials and modifications in the original process have provided a broad range of interesting properties. Their dielectric strength, mechanical strength, particularly compression and impact, light weight, chemical resistance, wear resistance, low coefficient of friction when lubricated with water, grease or oil, and machinability with ordinary machine tools have led synthetic compositions into many and varied applications in the tough jobs of industry. One which has recently come into prominence in the marine industry is propeller shaft and rudder stock bearings.

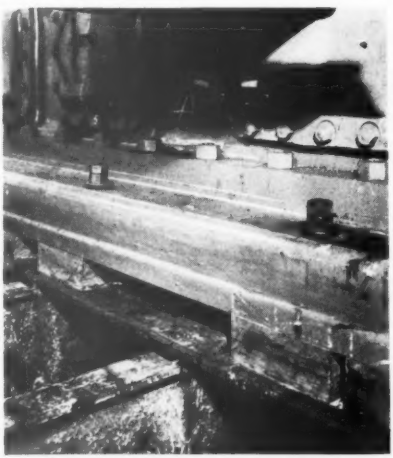
First Plastics Stern-Tube Bearing Installed in 1933

The grades of plastics available in 1933 had already been tried unsuccessfully in stern-tube bearings. That year a special type of resin was developed for plastics steel mill bearings and was introduced also into marine bearings. An installation was made on the "Steel Exporter" on November 3, 1933.

The shaft diameter was 16⅝″ and the length of the bearing was 62″. The initial clearance between the bearing and the shaft liner was .080″. The last time this bearing was measured was on March 1, 1940, at which time the clearance was .203″ indicating a bearing wear of roughly ⅛″ in 6½ years.

The acceptance of plastics bearings by commercial ship owners from 1933 to 1941 was slow, as there was a tendency to compare with lignum vitae only the cost per pound. But as its use spread, operating records soon indicated ease of installation, reduced lay time, low coefficient of friction, longer wear, increased engine speed, reduced frequency of repairs. When these important operating economies were recognized, the use of resin-bonded plastics bearings became wide-spread.

Micarta mounting blocks are used to insulate the engine from the foundation.



A typical installation was made on the "Bethore" running between Baltimore and Valparaiso, Chile, carrying approximately 22,000 tons of ore and making roughly seven round trips of 10,000 miles each per year. Resin-bonded plastics bearings were installed on the starboard side August 15, 1936—lignum vitae was installed on the portside at the same time. When the shafts were drawn on April 15, 1939, the plastics bearing showed approximately .045" wear, with no appreciable wear on the shaft liner. The lignum vitae bearing showed 3/8" wear and the shaft liner was worn from 1/8" to 3/16". The portside lignum vitae bearing was replaced with plastics at that time. This ship had a broken propeller blade on one trip during which the speed was adjusted to hold vibration to a minimum and the plastics bearing took the beating. The owner of this vessel estimates a saving of several thousand dollars since plastics bearings were originally installed.

Since the war started, and the critical situation on rubber has been so forcibly brought to everyone's attention, the use of plastics bearings has extended rapidly. In addition to some 500 commercial vessels, plastics bearings are now installed on over 300 auxiliary naval vessels such as subchasers, minesweepers, escort vessels, tugs, rescue vessels, supply vessels, auxiliaries, aircraft carriers.

On-Edge, Stave-Type Bearing Most Desirable

Marine bearing plastics is a uniform material machined to a pre-determined snug-fitting clearance. This engineered bearing is installed in a minimum of time, eliminating the waste and labor of fitting encountered in lignum vitae bearings. Spare bearings are easily stored in shipyards or aboard ship for speedy replacement. The material does not deteriorate or dry out in storage.

The type of construction which experience proves most desirable to Naval architects and Marine engineers is the so-called on-edge stave-type bearing. The complete bearing is made up of two halves, each half consisting of a series of longitudinal staves wedged between keeper strips on each side. Each stave is accurately machined from plate material with the layers or laminations running edgewise or perpendicular to the shaft liner. Certain staves have lengthwise water grooves to provide for circulation of lubricating water. Water grooves are omitted on the center staves to give more bearing surface in the area of higher pressure. The clearance between bearing and the shaft liner is about the same as for saturated wood. Since the plastics is an organic material, it will absorb some water and in so doing, will change dimensions slightly.

A few cases of shaft seizure have been reported. Investigation showed that the bearings at time of installation were bored with insufficient clearance. The bearings had to be removed and re-bored to recommended clearances.

The frictional characteristics of plastics are relatively the same as those of edge-grain wood, but considerably lower than those of rubber.

Rudder stock and pintle bearings are made of both stave-type and tube-type construction. Lubrication grooves are machined on the inside surface. Rudder bearings are used for both grease and water lubrication.

Additional Applications Include Valves, Gears, and Mounting Blocks

Plastics bearings have also been applied to deck winches, anchor windlasses and pumps. Pump valves and piston rings of plastics material have been employed in pumps of all types because of their long wear properties and chemical resistance. Engine mounting blocks are used to absorb vibration and reduce noise between motor frames and ship structure. Plastics pulleys have been applied to mechanical telegraph systems.

This material has gained wide acceptance for switchboard panels, particularly on naval vessels, because of high dielectric strength and high impact strength.

PULL TO DROP TAKE-OFF GEAR
FINE
REVERSE
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
HIGH VOLTAGE CONNECTION
3 2 1 0 1 2 3
LOCATION AND LENGTH OF WHEEL TRAVERSE
BRAKE
POSITION #1 – OFF
POSITION #2 – ON
PUMP SPEED 700 S.S.F.
GOVERNOR SET AT 70 S.S.F.
GOVERNOR SPEED
WHEN TESTING SPEED LIMITING
GOVERNOR, FUEL OIL VISCOSITY
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PRACTICAL POINTS

IN MOLD DESIGN AND CONSTRUCTION

These continue the series of practical points in Plastics mold design and construction which began in March. They should prove equally helpful to designers, builders and users of Plastics molds and molding equipment. Handy reprints are available without cost. Address—Industrial Plastics, 2460 Fairmount Blvd., Cleveland, O.

38. Provide ample loading space in compression molds. Some molding materials have high bulk factors and they may require an unusually large loading well.

39. In laying out steam lines for heating compression molds make them run in series so the steam will have to pass all the way through the passages without danger of branch lines becoming water logged on account of not having any outlet.

40. Compression molds for thermosetting materials require even distribution of steam lines for uniform heating.

41. Compression molds for thermoplastics materials require even distribution and close spacing of heating and cooling passages for uniform temperature distribution and for rapid cooling and heating.

Injection Mold Design

42. Generally, arrange the guide pins to be fastened to the rear, or movable half of the injection mold, so they will be moved out of the way of the operator when he is working between the open mold halves.

43. Consider venting provisions carefully for injection molds. This may involve sectional assembly of the cavities, or selecting the orientation of the piece so that the material can fill the mold progressively without trapping air. Also it may be necessary to make special venting passages in the mold assembly.

44. Provide pillars in the ejector box to support the cavity backing plates and prevent their bending when the molding material is injected.

45. Make retainer and backing plate of stock of ample thickness.

46. Provide for heating and cooling injection molds. Drilled passages for steam or cold water are convenient.

47. Avoid sharp turns in runners as they increase the resistance to flow severely.

48. When a core extends beyond the mold half, it is good practice to make the guide pins longer than the longest core extension so the pins will enter the bushings before the cores enter the cavity. Also, the guide pins will support the mold half face down on a bench without having it rest on the polished cores.

49. Avoid holding the tool maker to a specified thickness on retainer and backing plates or on total shut height.

50. Stripper plates should be designed to ride on the guide pins, not on the mold cores. The stripper plate should be retained by stripper bolts to prevent its falling off and to insure that it will not be incorrectly assembled by the molding press operator.

51. Study a new job thoroughly before beginning to cut metal. Decide upon a sequence of operations and setups which will produce the finished tool parts as specified.

52. Be sure to leave stock for grinding, or for polishing where polishing is

likely to remove an appreciable amount of metal, as at the crests of threads.

53. Mark the tool parts with the name of the steel used. Thus, if it has to be annealed and reworked for any reason, the heat treater will know what to do.

54. Sink hobs deeper than the finished required depth so that the hobbed block can be squared true after hobbing.

55. Plastics materials will flash into cracks or openings which are .001" to .002" wide. Make fits accordingly to avoid flashing.

56. Do not fit delicate mold parts too tightly if they cannot be pressed apart without damaging a polished mold surface.

57. Begin polishing by removing tool marks evenly to avoid losing the truly machined contour. Use a coarse grinding material and then remove its scratches with a finer one. Finish polish with a "flour" grinding material.

58. Do not expect chromium plate to cover a poor polishing job. The steel itself must have a mirror finish to take a lustrous chrome plate. Chromium is extremely hard and it is much more difficult to polish to a luster than steel.

59. Steel parts may be built up with a deposit of chromium .0005" to .005" thick. It is often a convenient means to salvage a worn tool or a part which is slightly small.

60. Dents in a mold surface may be repaired by upsetting the metal to bring up the depressed surface so it can be polished back to its original level.

61. Pin holes or flaws in the steel mold cavity can be repaired by boring a hole and filling it with a plug, which is pressed or furnace brazed in place. It may leave a mark on the molded piece, so it is best to do this kind of repair job where the mark will not be critical.

62. Damaged mold parts may be rebuilt or repaired by atomic welding a metal of the same composition as the parent metal. This results in an undetectable joint if properly done (preferably by a specialist).

63. Chamfer the rear edges of pin holes on their diameters so the pins can start into them readily.

64. Relieve pin holes on their diameters so the pins need not be fitted for more than ⅜" to ¾" of their length.

65. Polish core pins lengthwise so the molding can slide off easily.

66. Avoid burrs on cavity mouths, pin ends and other mold parts. Besides showing up poor workmanship, the burrs may scratch the molding as it is removed, or they may make it difficult to remove.

67. Avoid undercuts, even if only a few thousandths of an inch, on core pins because they make it difficult to push the molding off freely.

68. Check the length of core pins which enter cavities to be sure the pins are not too long before sending them to the press room for tryout.

69. Fit ejector and knockout mechanisms to operate squarely and freely.

70. Try out the assembling of the complete mold before sending parts to be hardened to make sure all screw holes and pin holes are in place and to make sure the parts go together.

71. Have someone check your computations before you begin a cut.

72. Use centering screws to mark drilled hole locations from tapped holes.

73. Use templates for the parting line contours of the opposing mold halves to assure a good match. Dowel the templates through holes bored through both cavity blocks while they are clamped together. Use the same dowels to hold the cavity blocks in line when fastening them to their retaining plates.

74. Work to the dimensions specified on the mold drawing.

75. Report apparent errors on drawings to the designer before you go too far.

76. Study the machine tools in your shop to know what backlash angular errors and the like must be compensated.

PLASTICS MOLD DESIGNING

by Gordon B. Thayer

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"Beetle" Colorful Member of Plastics Family

COMPLETE information, to date, on urea-formaldehyde molding compounds sold by the American Cyanamid Company, Dept. TJ, 30 Rockefeller Plaza, New York, N. Y., is contained in its new booklet, "Beetle Molding Materials."

First discussing the chemical makeup of Beetle, it points out the chemical characteristics that make this urea compound ideal for molded plastics, particularly where permanent color—distributed throughout the product—is essential or of added value.

Color has more than sales appeal, though colorful plastics do sell more readily. It has added advantages for safety purposes and for quick identification in everything from operation buttons on a turret lathe to the control handles at the switchboard of a Flying Fortress. Translucent plastics give soft, diffused lighting in desired colors. Being naturally a pearl white compound, colored Beetle is as color fast and color stable as are the best dyes or pigments.

Realizing that throughout the industry no two molds are exactly alike nor do any two molds present the same conditions of pressure, restrictions to flow or other variables, American Cyanamid manufactures Beetle in five grades, ranging from very soft—for severely under-pressured molding conditions—to very hard—for over-pressured molds. In addition to these five standard grades, several special grades to fit particular conditions or exposure are also manufactured.

Many of the book's 41 pages go into the technical problems of handling Beetle. Prewarming, flow, molds, temperature, molding pressures, cure, finishing operations, correction of molding defects and storage of finished parts are all discussed in detail.

In addition, urea-formaldehyde resin is used as a thermo-setting or heat-hardening resin because, when subjected to high temperature, it changes from a colorless solution, fusible and partially soluble, to a chemically inert substance. In the form of a solution, it is used for construction of translucent or opaque laminated sheets; for the manufacture of cold-setting cements; in baking enamels; as plywood bonds and in many other applications.

The last pages of the book cover the best design principles for molded Beetle parts, pointing out practices which make for smooth flow and even cure.

Beetle is used for a variety of products ranging from tableware to wiring devices. In the past few years it has been adopted for lighting reflectors, both in the home and in industry, where diffused light is essential.

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The last November 25 issue of *Chemical and Engineering News* contains two articles of special interest. One, a short account of the development and properties of soybean plastics, by G. H. Brother. The other, a discussion of the manufacture of hydrocarbon resins from unsaturated petroleum distillates, by C. A. Thomas. The latter article shows that resins with a variety of properties may be produced. The catalysts used are anhydrous aluminum chloride, sulfuric acid, activated clays and boron trifluoride.

APPLICATION of plastics to many bottleneck production problems is the story Creative Plastics Corp. has to tell in its new folder just issued and available to Tool & Die Journal readers who write the company at Technical Sales Dept. H, Kent Ave., near DeKalb, Brooklyn, N. Y.

"We can't tell you who's using them in what," Creative Plastics says of one war product it displays, "but before Creative entered the picture they were made of another material, with months required for delivery."

The company's technicians have developed new fabricating methods using plastics both in cases where this material was employed for its obvious advantages and as ready replacements for critical aluminum, brass, copper, steel, ceramics and rubber. These methods have helped many firms to achieve quick solutions of difficult parts problems.

All of Creative's plastics fabrication is done without molds and to closest tolerance specifications. Pointing out that plastics not only offer unusual strength characteristics but also new extremes in heat and arc resistance, high dielectric, low loss, and other interesting electrical and mechanical qualities, the company invites manufacturers to submit their problems in brief form, complete with blueprints or samples.

SAVINGS of millions of pounds in critical materials as well as thousands of valuable man-hours and machine-hours have been effected by the Navy Department through the conversion to war work of smaller plants in the field of plastics.

All phases of the Department's purchases are being examined to determine whether less critical plastics materials could be used as alternates for more scarce products like aluminum, brass, bronze, copper and high-quality steels. The result already has been a steadily increasing use of plastics in the manufacture of scores of important items purchased and used by the Navy. In many cases the plastics proved superior to the metals which they replaced.

FIXTURES for plastics molding machinery were added to items under allocation control by the WPB through issuance of Allocation Order L-159 as amended. "Fixtures" are defined in the amended order as the following new or used parts or groups of parts for plastics molding machinery: cylinders, feed screws, straight and cross heads, jet attachments, temperature control units and molds.

Definition of plastics molding machinery was clarified in the amended order by adding "ceramic injection molding presses or machines capable of being used for plastics" and "plastics tablet preforming molding presses or machines."

TO be used in place of rubber, a seamless plastic lining is now available for lining tanks, drums and pipes. It is at present being used in containers employed in nitric acid passivating and for most plating solutions. Tests with saturated salt solution show that the material will stand up to more than 200° without difficulty. The melting point is 550-600° and the plastic does not become appreciably softened until it reaches 350°.

SHIELDS of tough, transparent Lumarith fitted on automatic screw machines and turret lathes bring the splashing and loss of lubricating oil in metal processing operations under control. The shields are lightweight, flexible, easy to install and may be fabricated from sheet stock.

A TAPERED Nylon bristle by DuPont, meeting all the necessary requirements for a superior bristle (taper, resiliency, toughness, length, and inertness to paint ingredients) is replacing the now unobtainable lithe bristles of the famous razor-backs of the Orient. More durable than its natural counterpart, the Nylon brush is still for military use only.

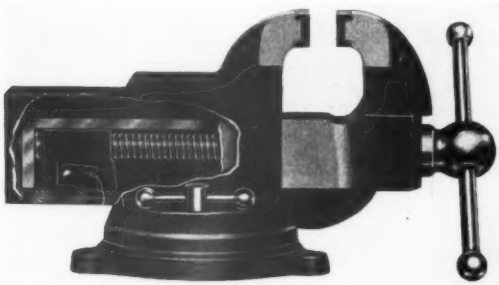
AN electric water light, encased within a container and dome molded of lightweight water-resistant Lucite, is being used to avoid the danger of an open flame in oil-slicked waters. The light illuminates automatically upon hitting the water.

A HANDY guide to selecting the right steels for plastics molding is offered by the Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

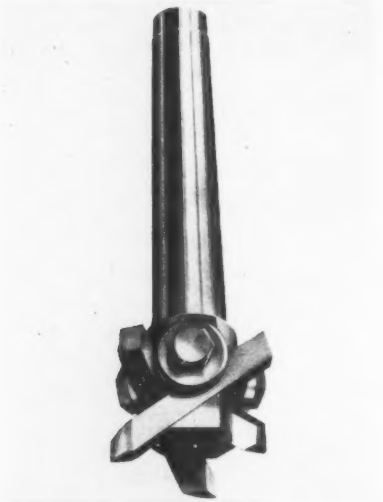
PROGRESS ON PARADE

THE special spiral design of the spiral fluted countersinks and counterbores manufactured by Schrillo Aero Tool Engineering Co., Dept. TD, Los Angeles, Cal., results in superior chip clearance, it is claimed. Both have hardened and ground shanks that are unaffected by chucks or wear. Countersinks may be sharpened repeatedly without sacrifice of cutting efficiency. In addition to an extensive line of cutting tools the company also makes precision plain and thread plug and ring gages.

ELIMINATION of the time consumed in "grinding" vises, to change jaw openings when working on parts of varying sizes, features a new line of Pacific vises. The quick action principle involves the use of a patented nut and pawl which makes it possible to open and shut the vise and to lock it in any desired position. When the pawl is engaged on the steel rack, as shown in the illustration, it is in working position and ready to grip the part. Pacific time-saving vises are offered by Pacific Vise Co., 6327 Hollywood Blvd., Los Angeles, Cal.

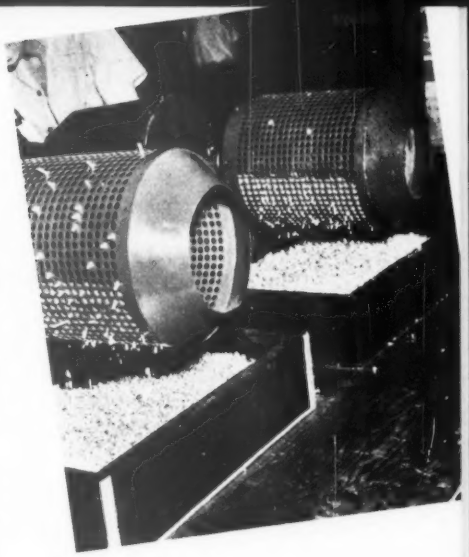


ILLUSTRATED is an example of a substitute superior to the original, produced due to the shortage of metals. The light weight Martindale protective mask now uses a preformed plastic frame instead of aluminum or zinc. The manufacturer, Martindale Electric Co., 1417 Hird Ave., Cleveland, O., states the plastic is superior to metal in reducing the weight of the mask to less than 2/5 oz. and in prolonging its useful life. The mask is recommended for protection against non-toxic dusts except free silica and asbestos.



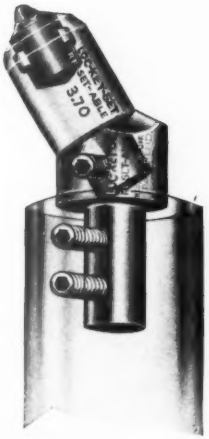
A NEW surface facing tool to take the place of standard end mills and shell end mills for surface facing is announced by Robert H. Clark Co., 3420 Sunset Blvd., Los Angeles, Cal. It consists of a tapered or straight shank and body with three adjustable high speed bits, which may be set for any diameter within the range of the tool. With only four tools, any diameter from 1" to 4½" inclusive may be obtained without being limited to standard fractional dimensions. A measuring gage is provided with each tool for quick and accurate size adjustments. The bits can be easily reground or can be replaced with new bits at comparatively small cost, thus lengthening the life of the tool indefinitely.

THIS milling cutter, designed for heavy duty work, is not only capable of maintaining high speeds and coarse feeds, but consumes a minimum amount of power, and has very little surplus stock to be removed when resharpening. The alloy steel housings are carefully heat treated with center hole and back face accurately ground. The ease with which the blades are adjusted forward to compensate for wear or grinding or are replaced when it becomes necessary is thoroughly appreciated by every tool room and die shop employee responsible for tool maintenance. For descriptive literature address Lovejoy Tool Co., Inc., Dept. TD, Springfield, Vt.

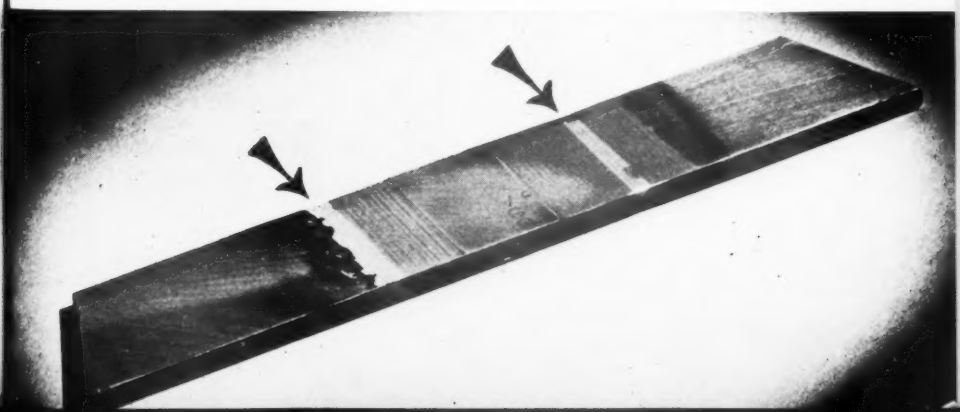


A NEW rivet sorting machine, resulting in enormous daily savings of vital aircraft rivets, many of them aluminum, has been developed by Fisher Body Division of General Motors. The old hand method is eliminated. The machine is now operated two shifts daily at the Fisher Aircraft plant, with an average output of 200 pounds of sorted rivets per day.

DIAMOND Tool Co., 953 E. 41st St., Chicago, Ill., manufacturers of diamond tools, turning and boring tools, announce a new 30° angle-set attachment for dressing 2" radius from a template with 3 or 4 karat common quality diamonds, permitting improved finish and speedier production. An important feature claimed for this tool is that it permits rotation of the nib to resharpen the diamond.



THE illustration below shows how Continental Motors Corp. fabricates an unusual tool (utilizing scrap high speed steel sections joined to mild steel body) by chamfering joints in X shape and joining the pieces with Castolin Eutectic Low Temperature Welding Alloy. This low temperature alloy provided a joint at 1300° F with only localized heating—thus preventing the annealing of heat treated high speed steel which retains all its original hardness. Address Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y., for further information.



INDUSTRIAL DIGEST

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

Simplify . . . Save on 315 Products

ELIMINATING unnecessary frills in the manufacture of 315 products during 1942 saved 60,000 tons of steel, 17,000 tons of copper, large quantities of other materials and enough man-hours to build 23 Liberty ships.

These reductions in the use of materials and man-hours were accomplished through issuance of approximately 100 WPB Limitation Orders affecting articles from hairpins to industrial power trucks, over the period from February 1942 to December 1942.

In addition to savings in the use of steel and copper, 82 simplification orders alone are estimated to have saved 180,000,000 yards of cloth, 30,000 tons of leather, 450,000,000 feet of lumber, 227,000 tons of pulp, 35,000 tons of solder and 8,000 pounds of tungsten.

Besides cutting out non-essential furbelows (simplification), these limitation orders have also standardized many products, both processes increasing production.

Standardization of actual war weapons becomes extremely important when it is realized that tanks, guns, and airplanes can be re-equipped more easily if spare parts can be counted on to be the same as the original. In the Armed Services themselves, standardization has gone far. Where the Army and Navy use the same weapons, they have agreed in many instances to standardize their components and have agreed to make common tests of battle-worthiness.

Reduction of many types of civilian products has been sharp. For instance, types of heavy forged hand tools have been cut from 1,150 to 357, mechanical water coolers from 27 to 8, industrial power trucks from 221 to 50, X-ray equipment from 100 to 25, and portable jaw and roll crushers from 25 to 5.

Other sharp drops have included auto storage battery types from 100 to 16, textile and paper shipping bags from 100 to 12, chemical fertilizers from 800 to 90, steel wheels and tires from 500 to 50, enamelware from 450 to 25 and fluorescent lighting fixtures from 200 to 2.

There's Cause, Cure for Absences

Study of causes of absenteeism has proved to be an effective first step in curbing this parasite of productive man-hours. Faced with the actual facts and some of the causes for job absences, joint worker - employer committees are doing something to remedy this situation.

For example, the Cleveland Tractor Co. reported that in spite of increased employment, a concerted labor-management drive cut work absences from 22,000 hours to 8,500 hours in four months.

The Bridgeport (Conn.) Brass Co. labor-management committee in one month reduced lost man-hours by 3,760, or 15 per cent, while the number of employees increased by 12 per cent. Three weeks after a similar campaign was

started in the American Screw Co., Providence, R. I., job absences dropped from 110 daily to 49.

Just how effective "records plus cures" can be was shown in a fairly complete study of the situation in production of Liberty ships in Maritime Commission shipyards. Although it showed great variation from yard to yard, depending on weather and other local conditions, great improvement in job attendance was noted in yards where record-keeping systems were installed to record absences, followed by programs to reduce sickness and accidents, and "morale programs" to let the workers know their responsibility and relationship to success in the war.

The main question, of course, is, "What causes absenteeism?" The answer includes a variety of reasons.

"Unavoidable" absences, caused largely by serious sickness and accidents, can be cut only by stimulated safety and health programs among workers—both at home and in the shop.

"Preventable" absences are due to minor illnesses and preventable accidents, poor housing and overcrowded or inadequate transportation facilities, fatigue caused by excessive work hours, job shopping and restlessness of workers and failure to keep materials and products moving steadily to assure maximum use of all workers. The answers to these problems are as varied as the causes and differ with localities.

Third in the type of job absences is the "Inexcusable," which comes from failures on both sides—by management's inadequate supervision, bad scheduling of work and arrival of materials, and labor hoarding; by workers' after-payday absences, time off for social engagements, hangovers and "war prosperity."

Great Britain, who has struggled with this problem since the beginning of the war, finds that the root cause of most of the problem—whether it is shop accidents or a Sunday morning hangover—is a too long work week. They have found improvement of factory and community conditions and programs to conserve the health and energy of workers as the most effective remedies.

"Learn-Do" Program a Success

A distinctive new worker training course that "pays-as-it-trains" and provides a combination of shop and classroom instruction differing in basic aspects from similar programs is paying dividends for Ohio Crankshaft Co., Cleveland, O.

Designed to meet the problem of fitting approximately 2000 new workers, many from non-essential industries, into machine shop positions at this company's plant, the course puts each worker on a two week training schedule calling for six hours actual shop work (supervised by competent operators) and two hours classroom study daily. Employees start their training period as regular workers at regular rates.

Classes meet six times a week around the clock—three per shift, nine per day—under the direction of Walter T. Lehman, training director, who originated the program. Newcomers having some shop experience or with high aptitude can complete the course in less time than the prescribed 12-day period, and outstanding trainees are pointed out to supervision as possibilities for more advanced work.

Included in the short, intensive course are the reading of blueprints, use of precision instruments, inspection technique, machine and shop nomenclature, gages and general shop procedure. A movie auditorium for the showing of educational films is included in the classroom facilities. The curriculum has been approved and certified by the State of Ohio and the Division of Adult Education of the Cleveland Board of Education.

INDUSTRIAL DIGEST

Besides increasing its present total of 4,000 workers, Ohio Crankshaft hopes to effectively replace the approximate 1000 male workers it expects to lose to selective service with women and older men through this training program.

Fabrication Effective In Tank Destroyer

Fabrication of armor plate rather than casting of it is a considerable aid to fast output because of its saving in machining time, according to Fisher Body officials who have used this method to put their new M-10 tank destroyer into volume production in an amazingly short time.

The turret of the M-10, for example, was designed for almost complete fabrication, in contrast to the cast turret of the famous M-4 tank, also produced by Fisher. Adaptation for machine welding was kept in mind in designing the destroyer and as a result much less hand welding is used than on the M-4.

The M-10, a powerful land cruiser-tank destroyer, was not built to supersede the M-4 tank, however, Fisher officials pointed out. Each is intended for specific purposes in battle and each is designed to best meet certain requirements. The M-10 has a lower silhouette than a tank but has a full track. Its chief mission in battle is to seek out and demolish the enemy's armed vehicles. Of welded construction and faster than the ordinary tank, it is heavily armored, has great maneuverability and carries terrific firepower. Although the caliber and range of the big gun mounted in the turret are secret, Army officials said it could trade blows on an even basis with the much-discussed 88mm weapons found on the most recent German tanks in North Africa.

You May Be a WIC!

Newest alphabet soup organization is the WIC or Women's Industrial Corps, christened by Pres. Harry Woodhead of Consolidated Aircraft Corp. as a symbol for the women workers in industry.

"Women fighting the hard battle of producing needed materials are as vital to our ultimate victory as any other woman who leaves her home responsibilities to replace men in war service," Woodhead said.

Production Army Joins Food Battle

At a time when the need for home produced food has become one of the most urgent tasks of civilian workers, the National Victory Garden Institute has organized and published a master plan for company victory gardens. Their suggestion is that companies locate and rent suitable land for employee gardens if their workers do not have such available, that they provide for preparing the ground and possible watering of it. Buying of seeds, fertilizer and insecticides can be a cooperative and more economical venture for employees if organized by the company, it points out.

Results for the company itself, the Institute suggests, will be alleviation of the desperate food situation, reduction of employee cost of living, healthful outdoor exercise for workers and improved employee-management relations through this exercise in cooperation.

Originally devised by L. A. Hawkins, horticultural expert of the International Harvester Co., the plan is now under the guidance of a group of gardening and industrial experts. Plans they have outlined for organization and simple

(Continued on Page 179)

FORMING TOOLS of tough Meehanite Metal successfully replace critical forgings

Forming tools, cast from Meehanite, ready to be tipped with carbide, are now available. We are furnishing them to an increasing number of users, supplementary to our line of Victory Tool Shanks.

In shop after shop, these tough Meehanite Forming Tools have demonstrated their ability to stand up in severe service. In certain respects they are preferable to forged tools. There is no limit to possible shapes and sizes. Cast accurately to shape in only a fraction of the time required to produce forgings, they are finish-machined very easily and quickly. They save critical forging steel and are substantially lower in initial cost.

Any company equipped to tip its own tools is invited to ask for our new 1943 catalog 53-T-2. Outline your tool needs and send dimensional drawings when you write. Just address The Cooper-Bessemer Corporation, Dept. J, Mount Vernon, Ohio, or Grove City, Pa.

Cooper-Bessemer

HOW WALES *Type "C"* HOLE PUNCHING UNITS STEP UP BOMBER PRODUCTION

Wales Type "C" Hole Punching Units in operation in one of America's largest bomber plants

Changes in the location of rivet holes on stringer, angle or shaped members no longer require non-productive hours of change-over time or days of wasted manpower caused by hand operations.

These time-saving, manpower-saving advantages are made possible by Wales Self-contained Punch and Die Units. To change a straight-line or staggered pattern is simply a matter of sliding each independent unit into relocated position on press brake rail. It's only a matter of minutes with a templet as a locating guide! No aligning of each punch and die is necessary because they are held in constant alignment by the Wales Holder—nothing is attached to ram of press.

Additional time is saved by using an extra group of Wales Units for set-ups on an extra rail off the press. When the operating pattern in press has completed production run, the rail with Wales Units can be quickly removed and new pattern set-up of Wales Units on the extra rail can be moved onto press brake bed ready to operate. This arrangement keeps press brake in practically continuous productive operation.

More planes of all types can be produced faster on your present press brake facilities with Wales Hole Punching Units.

Remember, "There's Always Something New in the Wales Line" so keep posted by writing to—

WALES-STRIPPIT CORPORATION

(Formerly The Strippit Corporation)
NORTH TONAWANDA, N. Y.
George F. Wales, President
Specialists in Punching and Notching Equipment

Determination of blanking die clearances

Information supplied by an Industrial Publication

Determination of proper blanking die clearance depends on several factors; thickness and physical properties of stock, relation of punch diameter to stock thickness, specified part tolerances and press power and size.

Recommendations of material suppliers regarding clearances for every type of blanking operation can usually be followed. Lacking recommendations, or when clearance must be determined by experiment certain simple rules give reasonably accurate results.

The amount of clearance varies from 5 to 12% in direct proportion to the stock thickness. Closer tolerances call for smaller clearances. The following table gives general average total clearances.

	Close Tolerance	General Run
Brass and Soft Steel	5%	8%
Medium Rolled Steel	6%	10%
Hard Rolled Steel	5-7%	12%

When the blanking or piercing hole must be held to a close tolerance, clearance is added to the punch dimensions. When the blanked part must be held to close tolerance, clearance is subtracted from the dimensions.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Ave. New York City

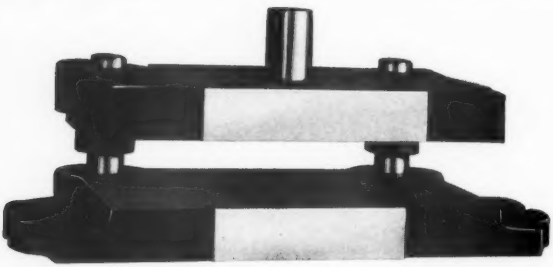
MOLY

DETROIT DIE SETS ★

STANDARD

DIE SETS and ACCESSORIES

SEMI-STEEL ALL STEEL



If today's shortages are affecting your output, write us regarding your problem. We are rendering helpful service to others . . . perhaps we can help you, too. Prompt shipment on standard die sets.

Precision Die Sets • Special Die Sets • Dowel Pins
Springs • Socket-Head Set Screws • Cap Screws

STEEL BOLSTER, STRIPPER AND PRESSURE PLATES

Made to Order . . . any shape . . . any size

Write for Catalog

DETROIT DIE SET CORP.
2895 W. GRAND BLVD. DETROIT, MICH.

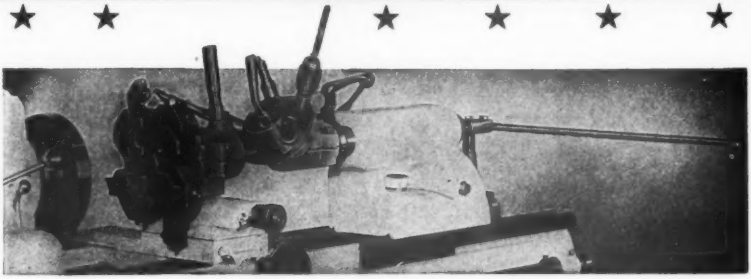
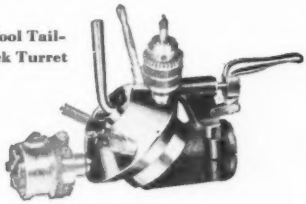


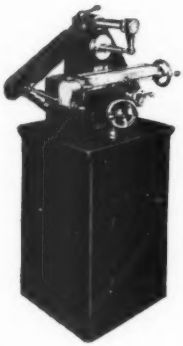
Photo above shows Jefferson Turrets on 16" lathe

Convert

YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

5-Tool Tail-Stock Turret



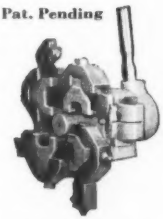


Yes, it's as easy as that! You simply attach the Jefferson Tail-Stock Turret, the Jefferson Tool-Post Turret, and the Jefferson Adjustable Pull Feed to your lathes as shown in illustration, above.

The productive capacity of these machines will be more than doubled in many instances because there will be available at all times NINE DIFFERENT TOOLS.

With these three JEFFERSON time-saving devices attached to a lathe, any kind of work may be done, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe, or changing tools. THE JEFFERSON TURRETS are made very substantial, rigid, accurate and in several sizes to fit small bench lathes up to 24" swing.

Pat. Pending



4-Tool Tool-Post Turret

We also Manufacture the Jefferson Bull Dog Precision Milling Machine. Obtainable Power or Hand Feed.

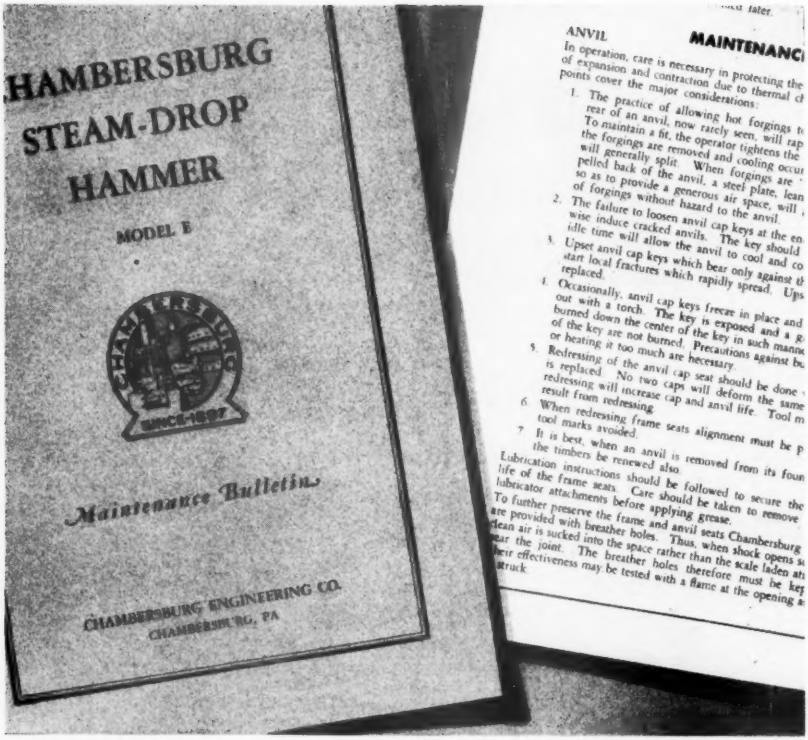
Jefferson Turrets are real production tools — substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

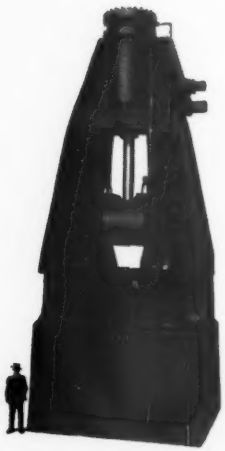
TURRET DELIVERIES IN 6 DAYS

Write for further details of these and other Jefferson time-saving machine tools and machinery.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.





Chambersburg 35,000 lb. Model "E" Steam Drop Hammer

GET THE MOST OUT OF YOUR HAMMERS

DROP FORGINGS are more essential today than ever before. Millions of forgings per year are needed for the aircraft program alone. Production of hammers at Chambersburg is at an all time high . . .Yet more are needed. Older hammers must therefore do more than ever . . . must last longer. There are many ways to get more out of your hammers . . . perhaps you can get some new ideas out of our Model "E" Steam Drop Hammer Maintenance Book . . . Write for a copy . . . even if your hammers are *not* Chambersburgs.

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

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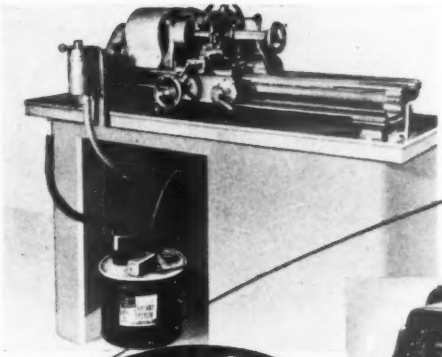
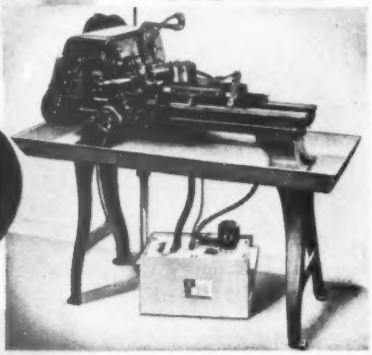
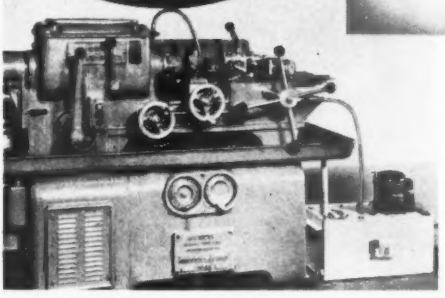
HAMMERS · CECOSTAMPS · PRESSES



Gray-Mills *Portable* COOLANT SYSTEMS



HELP good LATHES do their best



Gray-Mills Self-contained Coolant Systems operate independently of the machine tool and thus assure complete freedom from unnecessary vibration and accuracy-destroying motor harmonics.

SAVE *time and tools — increase production* by applying Gray-Mills Systems to your machine tools and equipment. The advantages of coolants have been given to lathes, like those above, by the simple and economical addition of coolant return pans and Gray-Mills Coolant Systems. Similarly equipped, hundreds of machines for milling, cutting, drilling, tapping, honing, belt grinding, sawing, etc. are producing more and better work. Gray-Mills Systems are the answer to increased efficiency in small, large or special tools—or as standby and "cleanout" systems. They are available in pump capacities from 50 to 1,000-gals. per hour—controlled flow. Prices range from $39.50 to $132.50. Call your distributor or write for full details. Gray-Mills Company, 211 W. Ontario St., Chicago.

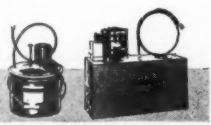
IMMEDIATE DELIVERY

FLO-BAC COOLANTS

Five types of quality cutting fluids to cover practically every requirement. Available in 10 and 55 gal. containers. Immediate delivery from your distributor, or our plant.

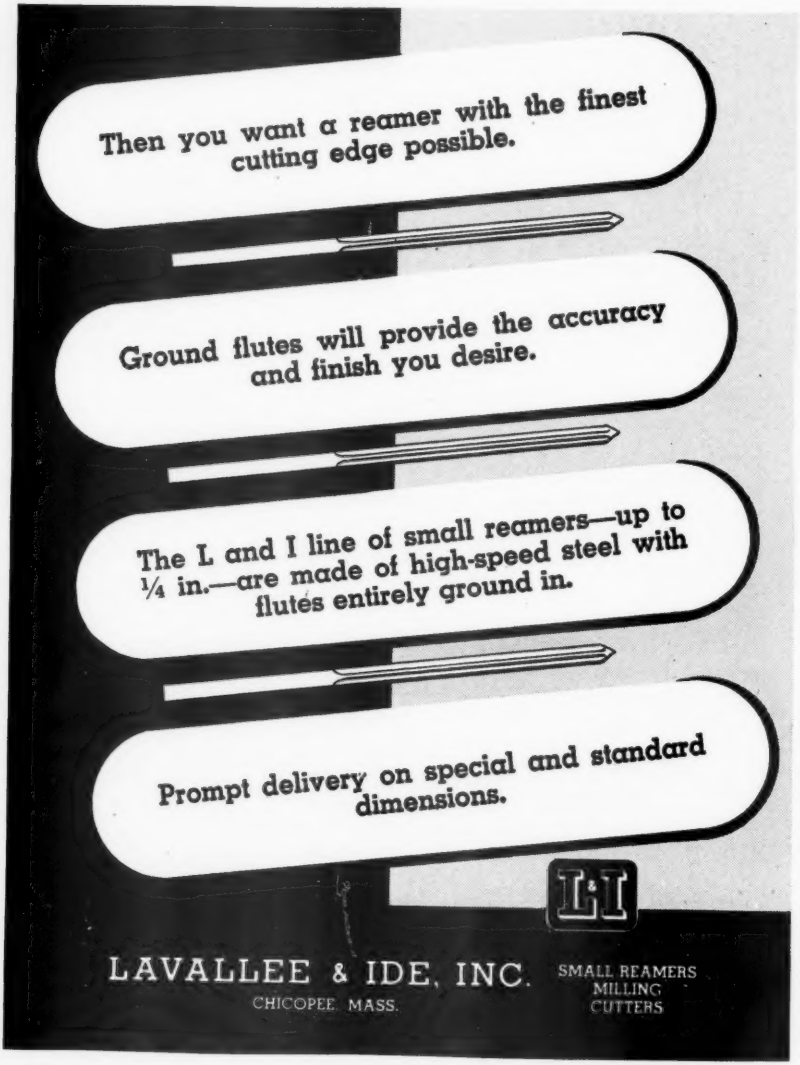
GRAY-MILLS

COMPLETE PORTABLE COOLANT SYSTEMS



Capacities 50 to 1000 G.P.H.
Pressures 8 to 150 lbs.

Are You Finishing Small Holes To Decimal Tolerances?


Then you want a reamer with the finest cutting edge possible.
Ground flutes will provide the accuracy and finish you desire.
The L and I line of small reamers—up to ¼ in.—are made of high-speed steel with flutes entirely ground in.
Prompt delivery on special and standard dimensions.
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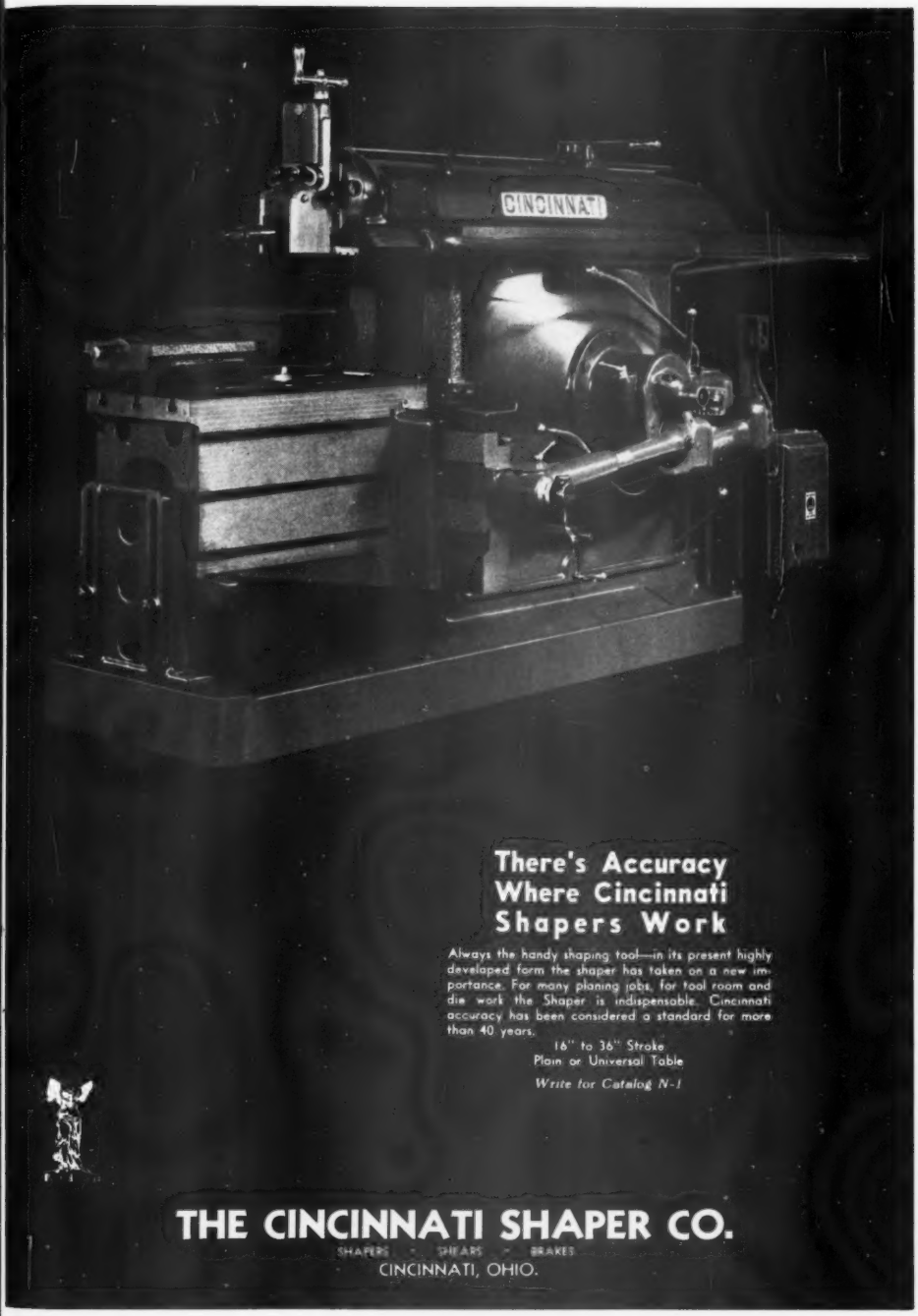
LAVALLEE & IDE, INC.
CHICOPEE, MASS.
SMALL REAMERS
MILLING
CUTTERS



There's Accuracy Where Cincinnati Shapers Work

Always the handy shaping tool—in its present highly developed form the shaper has taken on a new importance. For many planing jobs, for tool room and die work the Shaper is indispensable. Cincinnati accuracy has been considered a standard for more than 40 years.

16" to 36" Stroke
Plain or Universal Table

Write for Catalog N-1

THE CINCINNATI SHAPER CO.

SHAPERS - SHEARS - BRAKES
CINCINNATI, OHIO.

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- HIGHER SPEEDS
- HIGHER FEEDS
- INCREASED OUTPUT
- DECREASED COST

The New Centrifugally Cast Cutting Alloy Containing BORON

GRADE V: For heavy roughing on all types of high tensile strength materials (1/32" to 1/8" feed)
Rockwell "C" hardness 61-63

GRADE X: For medium roughing and semi-finish on all high tensile strength materials (.010" to .032" feed)
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GRADE XV: For finishing cuts on all types of materials. Also roughing and semi-finish on low tensile strength materials such as bakelite, brass, bronze, aluminum, copper, etc.
Rockwell "C" hardness 68-70

RECOMMENDED SPEED INCREASES OVER HIGH SPEED STEEL:

Low tensile strength materials	100% to 300%
Cast iron and semi-steel	100% to 300%
Steel castings	50% to 200%
Tough alloy steels	100% to 400%
Stainless and manganese steels	100% to 500%

KUTKOST SOLID TOOL BIT PRICE LIST (*Now ready for delivery*)

Size	Price Each	Size	Price Each	Size	Price Each
¼ x ¼ x 2¼	$ .95	⅜ x ⅜ x 3	$1.65	½ x ½ x 4	$3.25
5/16 x 5/16 x 2½	1.25	7/16 x 7/16 x 3½	2.40	⅝ x ⅝ x 4	4.70

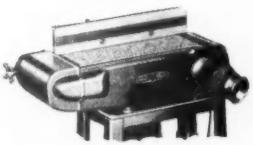
GENERAL TOOL AND DIE CORP.
553 PROSPECT ST. EAST ORANGE, N. J.

A Practical Solution for many Finishing Problems

There are dozens of sanding, polishing and finishing operations for which this Delta Abrasive Finishing Machine is ideal. It is husky enough to stand the grind of the production line. Its advanced design permits quick, accurate adjustments for a large variety of jobs. It is light enough to be easily moved around to just where you need it, and the price is surprisingly low. Find out for yourself why thousands of shops have found it so efficient for finning, finishing and surfacing metal and plastic parts.

Embodies Basic New Features

Every feature has been designed to eliminate disadvantages found in belt polishing machines. The frame is heavy and substantial; the adjustments are convenient and positive in action; attachments are quickly attached or removed; the machine may be used either vertically or horizontally, as required. Has many other features.



Send for

NEW CATALOG

giving full details and prices on Delta Abrasive Finishing Machines—and other Delta low-cost machine tools. Get in touch with your nearest Delta Industrial Distributor or send coupon below.

The Delta Manufacturing Co.
612-D E. Vienna Ave., Milwaukee, Wis.

Please send me your new Catalog giving full details and prices on Delta Abrasive Finishing Machines and your full line of low cost machine tools.

Name .....

Address .....

City .....State .....

(Continued from Page 94)

method of metal surfacing. This practice originated about 30 years ago but was comparatively inactive until 1935, when improvements in the process greatly widened its use. (Salvage and Conserve by Metal Spraying, the TOOL & DIE Journal, August '42, page 47.)

The metal so applied includes aluminum, babbitts, copper, brass, bronzes, lead, cadmium, Monel, nickel, stainless steels, carbon steels, tin and zinc, furnished in the form of wire or powder. This is fed into a spray gun, where the metal is melted by a high temperature flame, atomized and sprayed by compressed air onto the parts to be processed. Although in a melted state as it leaves the gun, the metal cools so quickly when it reaches the base metal that there is no danger of heat distortion. To obtain the best possible bond it is necessary to roughen the surface to be coated, thus mechanically anchoring the sprayed materials.

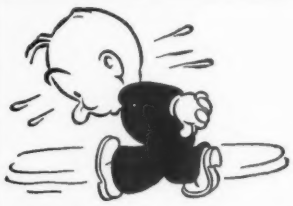
Spraying is especially adapted to coating large surfaces. In addition it may be used on surfaces so shaped and situated that other methods of application are impracticable—the inside of a large vat, for example.

Another advantage is that it is possible to rebuild some of the parts of large machinery without dismantling the entire machine. In this connection, spraying equipment is available in portable form and may be taken directly to the job.

Spraying does not produce a perfectly flat, smooth surface, but it may be filed, ground or polished. While sprayed metal has considerable porosity, this is a good feature for bearing surfaces, permitting lubricants to be absorbed and retained in the minute pores.

Applications to new products range from coating a small surgical light one inch long and one-quarter inch in diameter to metallizing a huge 75 x 11 foot pressure tank with aluminum. Hulls of small boats are coated with zinc. Structural steel is metallized. Fans on ships are coated with zinc to protect against salt water spray and vapor.

(Cont. on Page 144)



Don't worry about

DOWEL PINS

● We can give you good delivery on DIE-CO *Precision* Dowel Pins. Just tell us your requirements . . . and your worries are over!

DIE-CO Dowel Pins are the finest you can buy. Ground to tolerance of plus or minus .0001″. Standard pins ground .0002″ over listed diameters; over-size pins ground .001″ over listed diameters.

●

We can fill your requirements for all Die Maker's supplies, including a complete line of Springs in three standard types, and the amazing Hardsteel Drills that enable you to drill hardened steel without annealing.

DIE SUPPLY CO.

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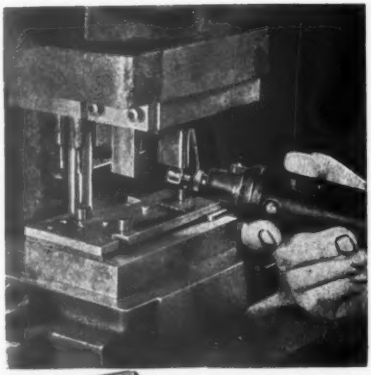
DREMEL MOTO-TOOLS

SPEED UP WAR PRODUCTION

Dremel Moto-Tools are speeding up war production in defense plants from coast to coast. These rugged tools tackle grinding, routing, buffing and finishing jobs with speed and precision . . . faster and easier, especially in close quarters . . . in hard-to-get-at places.

A Dremel Moto-Tool has a shock-proof bakelite housing, oil-sealed bearings, and a balanced armature to eliminate vibration and produce finer finished surfaces. It weighs only 13 ounces . . . can be hooked up to any AC or DC outlet. Used in America's leading arsenals of democracy . . . by General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Northrop Aircraft, Douglas Aircraft, and many others.



Tool makers find Moto-Tool's sensitive, finger-tip control indispensable when shaping intricate or irregular metal dies.

This complete Moto-Tool kit has accessories for all types of grinding, buffing and finishing operations . . . with steel cutting tools and the best abrasives. Consists of 1 Model 2 Moto-Tool with 3 collets: 1/8", 3/32", and 1/16", 4 Emery Wheel Points, 1 Dressing Stone, 8 Carving Cutters, 1 Steel Saw, 3 Bristle Brushes, 1 Steel Cleaning Brush, 1 Screw Mandrel with Sanding Discs, and 1 Shoulder Mandrel, one 1/2" Drum Sander. Packed complete in sturdy felt-lined hardwood cabinet case $23.50

Dremel No. 2 Moto-Tool only $16.50

Dremel emery wheel points, steel cutters and accessories with 1/8" shanks are available for quick delivery in a wide variety of sizes and shapes. They can be used with practically all makes of hand grinding tools. Write for catalog.

Moto-Tool is ideal for getting into close quarters, grinding, buffing and finishing to required specifications. For metal, wood, plastics, porcelain, glass, and other materials.

10 DAY TRIAL

Try a Dremel Moto-Tool for 10 days in your own shop. See how versatile, how indispensable it can become to fast, accurate work. Order from your industrial distributor, or contact any of the following representatives:

WEST COAST
THE FEDERATED SALES CO.
2437 West Valley Blvd.
Alhambra, Calif.

METROPOLITAN NEW YORK
MILL FACTOR PRODUCTS CO.
53 West Broadway
New York, N. Y.

NEW ENGLAND
F. V. FOWLER
116 Dartmouth St.
West Newton, Mass.

DREMEL MANUFACTURING CO., T-523-D, Racine, Wis.

(Continued from Page 142)

And so on ad infinitum.

Many industrial plants have their own spraying equipment. The service also is offered by job spraying plants.

The third method of applying metal surfaces is a fusion welding process, usually called "hard facing". The procedure was originated in the early 20's by originators of oil drilling tools and certain types of excavating equipment. (Reclamation of High Speed Steel Tools, The TOOL & DIE Journal, August '42, page 38.)

It is used for applying a coating, edge or point that will be resistant to abrasion, corrosion, erosion, heat, impact, or any combination of these. Among its other features, hard facing is especially adaptable where abrasion is severe.

Various alloys—ferrous and nonferrous—are applied. The most frequently used methods are oxy-acetylene welding, in which the material is generally sweated on, and metallic arc welding.

Deposits are from $\frac{1}{16}$" up in thickness. A strong bond or union is obtained. Hard facing deposits can be ground when necessary to have an exact dimension. However, where close tolerances are not required it often is unnecessary to do any finishing.

Wearing parts thus treated with hard facing materials generally give two to 20 times longer service than the original steel parts. The life of steam shovel dipper teeth has been increased three to seven times; exhaust valve seats, seven times; ingot tongs for handling red hot steel, three to 10 times; airplane tail skids, 20 times as many landings—to give a few examples.

One of the disadvantages of hard facing is that the heat may warp the part. When necessary to guard against distortion the part may be preheated, or it may be clamped, given a reverse bend, etc.

A fourth process, related to the three metal surfacing methods already described, is tipping of cutting tools with high speed steels, sintered carbides and hard nonferrous alloys such as the stellite types. (Brazing of High Speed Steel, The TOOL & DIE Journal, Dec. '42, page 64; Tool Salvage by Low Temperature Welding, Nov. '42, page 85; Carbide Tools in War Work, Oct. '42, page 42; Victory Tool Shanks, April '42, page 75.) It is the newest development of all the procedures, differing from the others in that small, solid pieces of cutting mate-

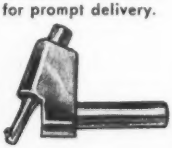
(Cont'd on Page 146)

MAKE-ALL RADIUS DRESSER

You will prefer the MAKE-ALL for simplified *Concave and Convex Radius Dressing* because it is so easy to operate. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.



$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by

Golconda Diamond Products Corp.

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GREAT LAKES
BROACH & GAGE COMPANY

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SNAP GAGES, FIXTURE GAGES, PLUG GAGES, TAPERED PLUG AND RING GAGES, HOLE LOCATION GAGES, SCISSOR GAGES AND FLUSH PIN GAGES----SECTIONAL FORM BROACHES, SERRATION, SPLINE AND INVOLUTE BROACHES, GAGES AND ARBORS.
Also INTERNAL and EXTERNAL GEAR GRINDING

X-Ray Inc., our new associate company specializing in Metallurgical Radiography, now also under operation.

BEHIND OUR BOYS FOR VICTORY

(Continued from Page 144)

rials are affixed by welding or brazing onto a supporting shank of cheaper and less critical metal—the attached piece being the working surface.

Sintered carbide tools have always been tipped because their lack of toughness requires a heavy backing of tough material. The tipping of high speed steels and nonferrous alloys is less common, though progress in this direction is proceeding rapidly.

Sintered carbide tips are brazed into place. Tipping with high speed steels and nonferrous alloys generally is done by brazing, although it can be done by butt welding. However, in brazing hardened high speed tips a low temperature brazing alloy must be used to avoid drawing the temper from the tip and losing the hardness. When high speed steel tips are welded the entire tool must subsequently be heat treated.

In one large aircraft manufacturing company it is the practice to cut up almost all broken or worn out larger size tool bits into small tips and utilize them as described. In this way, hundreds of pounds (from 60 to 90 percent) of high grade tool steel have been saved, in addition to time consumed in waiting for deliveries of new tools.

While numerous manufacturers, perhaps most of the larger ones, are turning to this method of tool conservation, there still remains a large percentage who do not use it. But pressure of war conditions is steadily converting the smaller companies.

Despite its destructiveness war does bring some progress and permanent benefits. Many production expedients and improvements developed during the last war were retained, among them welding.

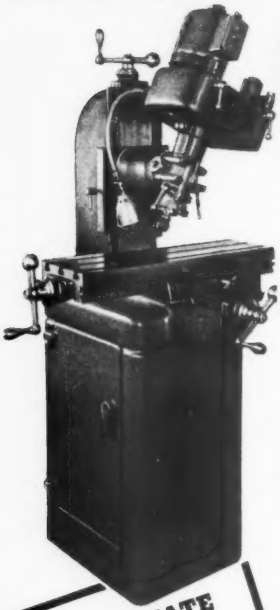
The remarkable growth of metal surfacing and tool tipping in this war is accomplishing a generation's development of the trend within a few years.

GILBERT L. DANNEHOWER, M.E., has been appointed Sales Manager of Swiss American Gear Company, Jersey City, N. J., manufacturers of precision gears. Mr. Dannehower will also manage the sales of Cosa Corporation, Chrysler Building, New York City, exclusive importers of Swiss precision machinery, particularly Sip Jig Borers and other high precision tools.

HOLLAND MILLER

With

SWIVEL HEAD



This rigid and versatile miller answers the need for a flexible toolroom and production machine with an unusually wide range of speeds. Note these exclusive features:

- Controls of table and head are all reached conveniently from the operator's seat.
- Rigid table mounting at permanent height provides extra stability and accuracy.
- Swivel Head, with motor centered above spindle, has 8" travel and 3" quill feed.
- A wide range of speeds, 200-4375 RPM, with standard motor, or 1/3 less with slow speed motor, is offered for boring and high-speed milling.

Write TODAY for complete specifications and descriptive details.

IMMEDIATE DELIVERY

MARBURG BROTHERS INC.

88-92 West St. New York

FOR THE DURATION

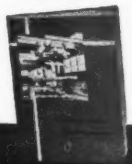
AND LONG AFTERWARDS

AMERICAN MONORAIL EQUIPMENT

offers versatile application without costly adjustment or lengthy engineering.

You can better your production NOW—later in the post-war period you will have essential equipment available for changes in product or process.

American MonoRail handling equipment is extremely flexible. Standard parts fit quickly and easily into complete systems that solve a wide range of handling problems.



WRITE FOR Blue Book illustrating hundreds of MonoRail installations.

Don't let your handling problems impede your war work. Let our engineers show you how to speed up NOW with an eye on easy, inexpensive adjustment when Victory is ours.

THE AMERICAN MONORAIL CO.

13131 Athens Ave. Cleveland, Ohio

Glass Surface Plates

CADILLAC Glass Co. announces the production of glass surface plates, available in degrees of accuracy from .0002" to .0005" and in standard sizes from 8" x 8" to 12" x 12". Special sizes up to 18" x 18" are also being manufactured.

Originated due to the increased demand for surface plates and the difficulty of securing them because of critical materials, the glass models are now proving to have advantages of their own. Wear is negligible as the surface of the glass is very hard. Since scratches do not burr, they will not cause surface errors. The low coefficient of glass expansion indicates very little change due to variations in temperature.

Glass surface plates are non-conductors of electricity and will never require demagnetizing. They require no oiling of the surface as they will not corrode.

As these plates are made from heavy, clear glass, drawings or data that is to be referred to frequently may be placed beneath them, thus providing protection for the prints and still making the data readily available. Where required, permanent records may be etched on the lower surface of the glass.

Further information will be supplied by Cadillac Glass Co., 903 W. Cermak Rd., Chicago, Ill.

STURTEVANT
QUALITY
Protect!...
You too can protect your production with STURTEVANT TORQUE WRENCHES —the permanently accurate measuring wrenches which are used to assure the uniform tightening of screws, nuts and bolts, in most aircraft engines, to control the "set" of threaded parts in delicate instruments, to test the frictional drag in giant diesels—for controlled uniformity in assembling, for rapid inspection . . . for testing, gauging, measuring torque.
Each day brings new uses for STURTEVANT TORQUE WRENCHES, new applications where they speed production, increase operation control and assure product quality. These patented flat beam wrenches, produced by the pioneer manufacturer of accurate torque wrenches, have double-faced dials, readable from any working angle, practically indestructible and above all are permanently accurate!
NO
FRICTION
ADJUSTMENTS
MOVING PARTS
FRAGILE
MECHANISMS
CAPACITIES
from
0 to 7200
inch pounds
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

With this Amazing TRIG-EASY CHART every man whose work requires a solution of problems involving angles can save his time and time for those who must wait for calculation — and eliminate all errors through use of wrong equations.

TRIG-EASY MAKES TRIGONOMETRY EASY

(without knowledge of higher mathematics)

You have 40 Trigonometric Equations at your finger-tips. TRIG-EASY pays for itself every time it is used. It is a handy vest or shirt pocket size, grease-proof and sturdy to resist moisture and dirt.

Send only 50c for your TRIG-EASY with complete instructions and MONEY-BACK GUARANTEE.

E. H. Needham

TRIG-EASY

Dept. X. Culver City, Calif.

QUANTITY DISCOUNT TO INDUSTRIAL FIRMS

BREAK THE BOTTLENECK

Machine Shop; Tool Die; Jig Bore; Patterns; Layout, Inspection, Drafting. On every job where angles and dimensions are different. Speed production through education of Personnel.

Versatility-Plus Claimed For Fray Vertical Miller

FRAY Machine Tool Co. offers the trade its new ram type No. 7-B vertical universal milling machine, complete with the plus-features needed in today's production drive. Built expressly for firms wanting a precision tool on which both the cross and longitudinal movements of the head are definitely controlled, machining operations with this Fray model can be done at any angle in either or both the vertical and horizontal planes—without changing the work set-up.

By traversing the ram on the turret slide, or by operating the ram in its saddle, all milling, drilling or boring operations are possible at any desired angle. This makes it particularly valuable for tool rooms and die shops, as well as for production work.

Hand wheel or lever feed is provided, and the wheel feed is equipped with a calibrated dial graduated in one-thousandths. All adjustments for table travel, ram travel and turret position are also graduated for accurate settings.

The table measures 7½" by 29" and has a longitudinal travel of 12". The combined table and turret cross slide travel is 22". Ram travel in and out is 10" and cross feed travel of the table is 7", which gives a combined ram and cross feed travel of 17". Frayco electric motors are used for both the table and spindle drives.

Information will be gladly furnished by Fray Machine Tool Co., Dept. H, Glendale, Calif.

20000 R·P·M
CLEAN and FAST ROUTING
PRODUCTION — MORE PRODUCTION
— STILL MORE PRODUCTION
Reduce that constant pressure for More Production by using our 3100 Router powered by General Electric Universal Motor; spindle operating on New Departure Precision Type Grease Sealed Ball Bearings delivers 1200 Watt output; RPM of spindle 20,000; chuck capacity ¼" to ½"; foot pedal raises and lowers 18" x 14" table which moves on machined dove-tailed ways — foot pedal is tripped under a plate to hold table stationary.
Eat into that backlog of orders by using a Duro 3100 Router.
DURO METAL PRODUCTS COMPANY
2653 N. KILDARE AVE. CHICAGO, ILL.
DURO
DURABILITY
DURO Router Shaper
FOR NON-FERROUS METALS · PLASTICS · WOOD

Reclaim Your High Speed Steel Cutters

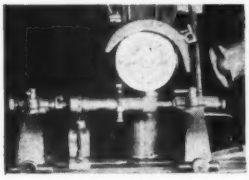
By Brazing-on STANDARD CARBIDE BLANKS

When your high speed steel cutters are "worn out", don't scrap them. They usually can be reclaimed by simply torch-brazing standard carbide tips to the cutting edges of your cutters.

Standard styles of carbide tips are readily available to meet practically all carbide tipping requirements for all commonly used types of high speed steel cutters. With a small master stock of standard tips in your crib, you'll be prepared to reclaim and re-tool fast.

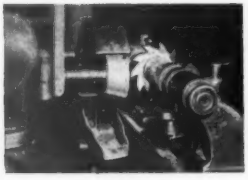
Complete instructions on request.

THREE EASY STEPS AND YOUR OLD CUTTERS ARE RENEWED



1 First grind a recess in the faces to which the carbide tips are to be brazed. Plan recess so that tips will project slightly over edge—for grinding back to size. Bottom of recess should be ground flat surface but not necessarily smooth.

2 Using an oxy-acetylene torch, flux, and silver solder, braze standard carbide tips in place. Process is essentially the same as regular braze for carbide tools—except braze should be completed fast to prevent oxidization and loss of chrome.



3 Grind carbide tipped "high speed steel" cutter in same way you regularly grind any carbide tipped cutter. Cutter is now ready for many times life of the original. When again worn, you can often resize using same process.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11109 E. 8 MILE STREET, DETROIT, MICHIGAN

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

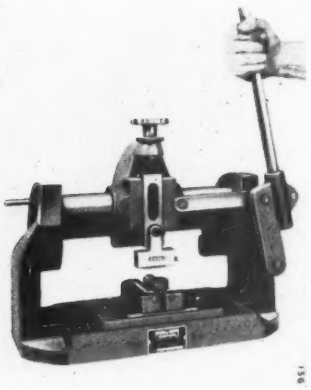
Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

✓ Brazing literature sent on request.

CARBOLOY CEMENTED CARBIDES

TRADEMARK

TOOLS • DIES • DRESSERS • MASONRY DRILLS • WEAR RESISTANT PARTS



New Operators Find Marking Machine Simple, Efficient

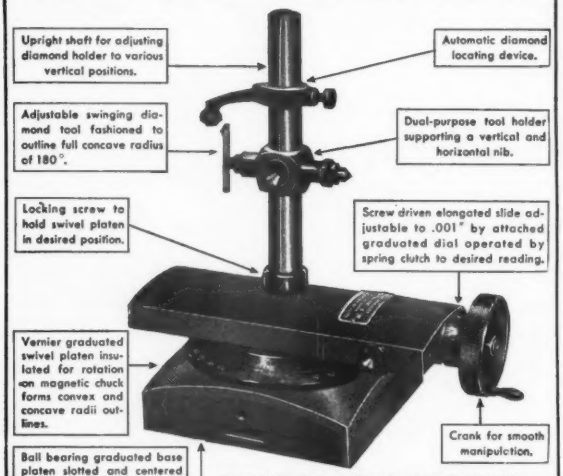
ITS simplicity recommends the new AcromarK No. 9A Parts Marking Machine for use in the war production program, because untrained personnel can make perfect markings at all times on shells, shot, tubular and cylindrical parts and pieces. Moreover, it has been especially designed with a view to eliminating adjustments and other time-consuming motions.

Besides its simplicity of operation, it is extremely efficient. At the pull of the lever, a uniform mark of any desired depth is made and another part is marked on the return stroke. Serial numbering is accomplished with an automatic number head, and repeat numbering is possible by a single adjustment. Intermittent marking or controlled spacing is also very easily handled, a geared mandrel and straight line holder assembly being used. Available accessories such as these make neat precision markings easy with either the hand operated or motor-driven models. In addition, the motorized unit can be adapted to the operator's skill, as its set speed can be altered to suit his individual feeding speed.

Construction details include gray iron castings for base and head, shaft and bearing bar of cold drawn steel and head gibs and slide of tool steel; all bearing surfaces are cast iron against steel. Height—14⅜"; length—17¼"; depth—7¾".

The AcromarK Corp., 5-15 Morrell St., Elizabeth, N. J., will send prices and more details.

SPEED PRECISION GRINDING


Upright shaft for adjusting diamond holder to various vertical positions.
Automatic diamond locating device.
Adjustable swinging diamond tool fashioned to outline full concave radius of 180°.
Dual-purpose tool holder supporting a vertical and horizontal nib.
Locking screw to hold swivel platen in desired position.
Screw driven elongated slide adjustable to .001" by attached graduated dial operated by spring clutch to desired reading.
Vernier graduated swivel platen insulated for rotation on magnetic chuck forms convex and concave radii outlines.
Crank for smooth manipulation.
Ball bearing graduated base platen slotted and centered for flexibility of installation is simply and quickly mounted.

MEYERS "DIA-BRASIVE" RADIUS-ANGLE FORMER

ELIMINATES LOST MOTION

● Engineered for absolute precision, this Meyers tool gives speedy, precise and economical shaping and truing of grinding wheels from any angle. Difficult radial and angular outlines quickly formed. Easily installed on various machines. Vertical and straight diamond dresser nibs are standard equipment. Write for literature. Manufacturers representatives wanted in East, West and South.

W. F. Meyers Co., Inc., Dept. T, Bedford, Ind.

Expert Tapping with "Green" Help

Procunier Tapping Machines are designed to permit unskilled men and women workers to tap like experts. Actual production records show that "green" help get more accurate tapping, faster with less tap breakage—when they use Procunier Machines. Here's why: The extra-long spiral compensating springs, with wide range of hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF THE OPERATOR! Other Procunier features that step up your tapping output are: 1. The improved Procunier tapping head with double-cone cork-face friction clutch; 2. Four speeds, ranging from 390 to 2050 RPM, efficiently handle jobs for which conventional high speed tapping machines are inadequate; 3. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads.

Tap Establishes Its Own Lead

The new Procunier Universal Tapping Machine is exclusively designed so that it actually allows the tap to establish its own lead. There is nothing more accurate than a precision ground thread tap as a guide for tapping—so maximum tapping efficiency is attained where an accurate tap is free to establish its own lead in cutting the thread.

SEND FOR CATALOG giving full details, description and prices on the full line of Procunier Universal Tapping Machines, hand or foot operated, the complete line of Procunier Precision Tapping Heads to meet all needs and the new Tru-Grip Tap Holder.

PROCUNIER

SAFETY CHUCK COMPANY, 12-14 S. Clinton St., Chicago, Ill.

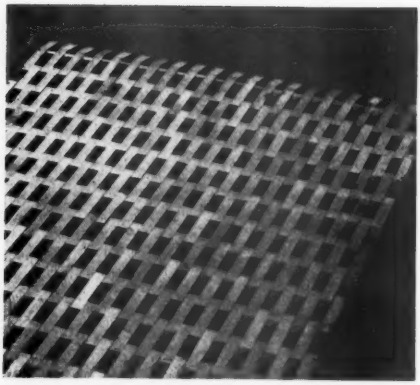
PROCUNIER SAFETY CHUCK COMPANY
12-14 S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name .....

Address .....

City .....State .....



Wood Mats Take Place Of Vital Rubber

FLEXIBLE wood link matting, developed as a substitute when rubber and similar material were put on the critical list, has been announced by the American Mat Corp.

This wooden substitute handles the same problems rubber matting did, providing safety and comfort underfoot and good drainage. Substantially constructed of wood links, the mats are light in weight and can be rolled or folded up for easy handling and cleaning. Lying flat, they follow the contour of the floor. Ends are beveled to reduce the danger of tripping.

One inch thick, they come in stock sizes: 18" x 32", 24" x 38", and 30" x 44" but can also be obtained in special sizes of any length and up to 36" in width.

This flexible wood link matting has proved itself durable and able to withstand abuse far beyond that encountered in common usage in factory tests around machinery on oily and greasy floors. In some instances the new types stood up even better than the originals.

The manufacturers of this special matting have also set up a special service and advisory department for the duration to help in conserving present matting through proper care.

Detailed literature on this service or on the new wood matting will be sent upon request to American Mat Corp., 1791 Adams St., Toledo, O.

Federal Taperlock

Plastic GAGE HANDLES

Immediate Delivery!

★ Made of durable plastic material, they are lighter than any metals used for Gage Handles.

★ This light weight makes gages more sensitive to touch and reduces fatigue caused by long continuous use—particularly in the case of women inspectors. Insulates from bodily heat, helping maintain accuracy of gages.

★ Made to fit gages of standard sizes. Easily marked for identification with the same lettering used for metal handles.

★ The low cost represents a real saving. **Available in 6 standard sizes, in any quantity and without delay.**

★ **COLORS!!!** A new feature in Federal Gage Handles. Permits quick identification of types or sizes without measuring gages. Available in BLACK—RED—YELLOW—GREEN.

FEDERAL TOOL CORPORATION

400 North Leavitt Street **Chicago, Illinois**

American No. 2

PLAIN MILLING MACHINE

for
SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r.p.m.

Standardized Spindle Nose. Spindle heat-treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

PROMPT DELIVERY

SEE OUR CATALOG IN SWEET'S

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46"x10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

J. L. LUCAS & SON, INC.

BRIDGEPORT CONNECTICUT

Lapping Machine Produces Optical Flatness

FLATNESS to the limits of one light band (12 millionths of an inch) or under and tolerances as low as one micro-inch RMS for smoothness are the promise of the manufacturers of Ultra-Lap Machines.

Special machines for special requirements will be worked out by the company when specifications are submitted—and the resulting machines will be guaranteed in each case to meet the specifications for flatness and smoothness and for quantity production agreed upon at the time the order is placed.

Engineered to surface finish any metal or material, as soft or softer than copper or as hard as Nitralloy—or any combination of such materials, the machines are nevertheless easy to operate and so designed that, as need arises, the lapping plates may quickly be reconditioned in the individual shop.

Model No. 10, illustrated above, has a lapping plate of 18" diameter, 3 HP ball bearing motor with electrical requirements to suit the customer. The lapping table spindle is ball bearing equipped with bronze and steel thrust bearings.

Body construction is of heavy cast iron frame with overall height of 82" and approximate weight of 2200 lbs. It occupies 29" by 32" of floor space.

More specifications on this machine or on any other models may be secured from Ultra-Lap Machine Co., 245 McDougall Ave., Detroit., Mich.

Get Longer Life From Your
PERISHABLE TOOLS

HILCO UNIVERSAL TOOL and CUTTER-GRINDER

Perishable tools — so difficult to obtain today — last longer, cut better and quicker if kept always sharp. The HILCO Universal Tool & Cutter-Grinder costs only $495.00 F.O.B. Chicago, complete with Universal Index Dividing Head, step collars, ¼ hp. 110 volt universal motor, index fingers, grinding wheels, etc. Quick delivery.

Write for circular and full specifications.

BERCO MANUFACTURING CO. 433 W. Superior St. Chicago, Ill.

DIE DESIGNING AND ESTIMATING

CONTENTS

New Chapters include:
Progressive Dies
Compound Dies
Drawing Dies

(Deep drawing section on cartridge case design, mathematical and graphical methods of determining diameters, shell wall thicknesses, punch and die sizes)

Outline of Equipment and Operations for Manufacture of Small Arms Cartridge Cases

15 New Estimating Tables

Separate Index of Time Value Tables

150 Practical Points on Die Designing and Building

★ "Will be extremely helpful to us . . . .", "very practical", "even better than I had hoped it would be"—these are comments by men in the precision tooling industry who have examined the new second edition of "Die Designing and Estimating". Orders for 50 copies (most on a second order after the book was reviewed) from a public library, 28 copies from an airplane manufacturer, 24 from an apprentice training instructor testify to the usefulness of this book. Largely written on request by specialists, the book covers its subject concisely, systematically and with authority.

The 160 pages have over 125 drawings, charts and photographs carefully selected to illustrate modern die designing practice. The estimating data (largely that of George Dannes) is complete enough to follow from rough sketch to a final, sound estimate.

Send for your copy today. Price $3.00 per copy plus postage. Write for quantity discounts.

AMERICAN INDUSTRIAL PUBLISHERS

300 Fairmount-Cedar Bldg. - Cleveland, Ohio

A. C. E. Is "Tailor" for Metal Working Firms

TAILOR-MADE tools—only—are provided for a large proportion of the nation's most important metal working firms by American Cutter & Engineering Corp. Each tool made is manufactured to customer's blueprints as an individual problem requiring the same work planning and machine set-up as a stock tool. Despite the fact that this individual planning keeps tool prices out of line with catalog prices, some customers frequently send orders for individual manufacture of standard tools, feeling in special instances that American Cutter's uniform quality and attractive deliveries offset the difference in price.

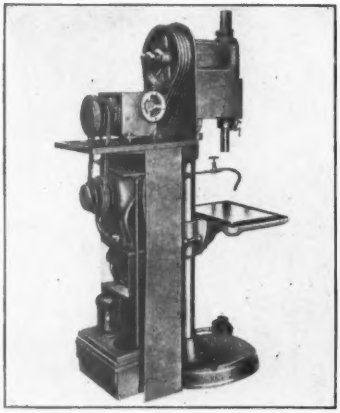
Facing increased production, along with many other firms, American Cutter & Engineering met the problem of maintaining quality through installation of the latest machinery and equipment and establishment of an inspection department equipped with A.C.E.'s own special testing apparatus and organized as a separate unit.

The variety of products manufactured by this firm includes all types of arbors, boring tools, checking tools, counterbores, countersinks, drills, end mills, form tools, milling cutters, metal shears, reamers, spotfacers and saws.

Specifications for individual jobs will be gladly reviewed by American Cutter & Engineering Corp., 31753 Mound Road, Warren, Mich.

Send us your
SPRING PROBLEMS
● If you need special design, special quality or special delivery, the chances are we can help you. Redesign may modify costs, too. This specialized organization, recognized headquarters for all that is latest and best in spring making, is at your service.
WM. D. GIBSON CO.
1800 Clybourn Ave.
Chicago, Illinois
(Div. Assoc. Spring Corp.)
65 Years of Knowing How RESULTS IN BETTER SPRINGS
GIBSON-SPRINGS
INQUIRIES INVITED... LARGE ORDERS... SMALL

New Tapper Has Dual Control, 16 Speeds



SIXTEEN speeds, dual control, 1¼" capacity and precision depth stop are the four outstanding advantages pointed out by Cleveland Tapping Machine Co. for its new Model DB unit tapping machine. In addition, this model incorporates all the features of the older Model D.

Holes can be threaded in steel to 1¼" by this new machine. The tap is driven to a predetermined depth, at which point the motor reverses by action of electric controls actuated by an adjustable depth stop. This stop is set by turning a crank at the front of the spindle head in connection with a micrometer dial. Reversal takes place within a one-quarter turn of the spindle following the instant of reaching set depth. The tap is advanced and retracted by an interchangeable lead screw at the top of the spindle head assembly. Equipment includes a 3 hp reversing motor for the spindle drive and a motor-driven coolant pump and return tank.

The enlarged Buy-With-Confidence section, pages 218-234, will prove helpful in solving the "who-makes-it" problem.

The machine stands 74" in overall height and occupies a floor space 23" by 48". Its 12" by 16" work table is adjustable vertically on the column through 26".

More details are available from Cleveland Tapping Machine Co., 1724 Superior Ave., Cleveland, Ohio.

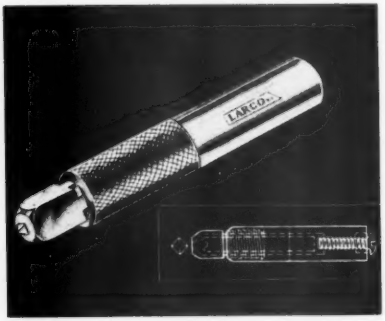
Sheldon BBU-1240 WQ Precision Lathe

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4236 N. Knox Ave. Chicago, U.S.A.

"Plus-Five" Tool Holder New Larco Product



DRAMATIC economies in tool cost, time and effort are offered the many users of diamond tools with a new "Plus-Five" patented shank model just put out by Larco Tool.

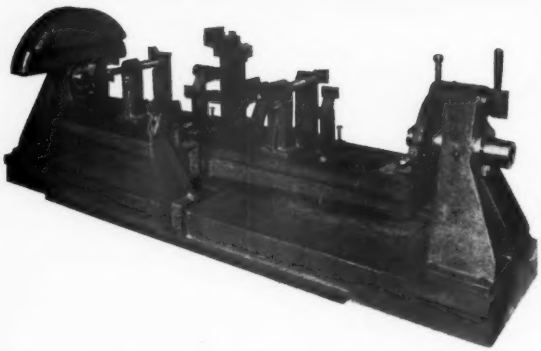
Now the operator is enabled to reset the point of the diamond himself . . . efficiently and speedily (in fractions of a minute). With this new tool on the job all the time and no further need to send it back for resetting, a reserve tool stock is unnecessary.

Designed to take a high quality diamond, polished at the Larco factory, the tool is made so that on any of the six interchanges of point, the octahedron diamond is always in dead-center. It is sold with either one cap for a specified size diamond or with several caps to take several sizes.

The holder may be retained indefinitely for continuous use on dressing jobs.

Dept. T-J, Larco Tool Division of Louis A. Roselaar, 551 Fifth Ave., New York, N. Y., will be glad to furnish details.

We Sell Precision . .



★ Dies, Jigs, Fixtures, Special Machinery and Designing.

Hardened and Ground Parts to Order.

MASTER MACHINE & TOOL COMPANY

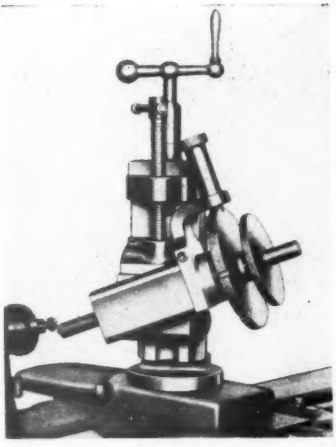
925 WEST NORTH AVENUE, CHICAGO, ILL.

REPRINTS

"Typical Designs for Drilling Jigs and Fixtures," a series in six parts, has been reprinted by popular demand. This series has been written by C. W. Hinman, well-known engineer and author of "Pressworking of Metals" and "Practical Designs for Drilling & Milling Tools."

Copies may be secured by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O. Price, 25c per copy.

Milling Fixture Adds To Lathes' Versatility



AN essential in the modern toolroom or production department, the Thompson Universal Milling Fixture, illustrated, will convert any standard bench lathe, easily and quickly, into an economical, time-saving milling machine. Its vise and universal slide base can be used without an index fixture for straight or angular milling.

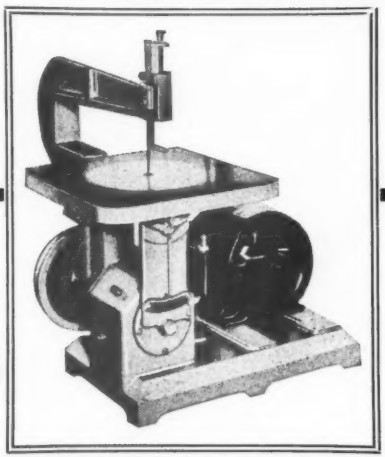
Just recently put on the market (its patents are still pending), this milling fixture has a three-way circular swing, making it possible for the converted machine to do work at right or acute angles or with the work extended through the fixture.

It is an efficient tool providing a wide variety of applications on milling punches, end mills, keyways, counterbores or in the manufacture of duplicate parts.

Also just introduced by this company is a new spring collet adapter, consisting of only two parts yet the perfect fit for all standard spring collets. Sure gripping and accurate, it eliminates large heavy chucks and is made for all taper spindle machines.

In addition to these two outstanding products, Auto-Ordnance also manufactures a complete line of Willard Spring Tool Holders for all types of machine tools. Threading, forming, high speed cutters and cutoff holders are included.

More information is available through Auto - Ordnance Corp., Thompson Tool Div., Dept. F, Greenwich, Conn.



Price, complete with motor— **$125** Net

F.O.B. Chicago

IMMEDIATE DELIVERY—Atlas Die Filing Machines

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

ATLAS EQUIPMENT CO.

101 S. Clinton St. Chicago, Ill.

Detroit Distributor—International Machinery Co.
3131 E. Jefferson Ave. Detroit, Mich.

Aget-Detroit Makes New Dust Collector

JUST announced by Aget-Detroit Co. is "Bench-Kop," a new, low cost, entirely self-contained, table type dust collector for collecting and storing the dust from one or more flexible shaft grinding, buffing, small band sanding or metal spraying operations.

The new unit employs a standard motor driven Dustkop dust collector, mounted as an integral part of the table and connected to a down-draft funnel. Shipped completely assembled and ready for operation, it requires no connection with a centralized system or secondary dust collector.

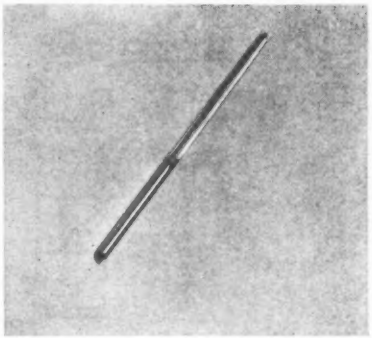
The Bench-Kop consists essentially of a wood table with a wood grille top, under which is installed a sheet metal funnel, which in turn connects to the intake of the 600 CFM, Model 600 dust collector, such as is used for exhausting the dust from surface, tool and disc grinding operations.

A baffle plate immediately under the removable wood grilles permits the easy recovery of any heavy pieces of metal, parts or tools which may be dropped through the grille. This baffle also collects a considerable portion of the heavier dust and dirt and is so arranged that the greater portion of the suction is along the two back sides of the table where, according to experience, the greatest suction is required.

More details may be obtained from Aget-Detroit Co., 2064 Book Tower, Detroit, Mich.

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. · DETROIT, MICH.

War Production Problems Aid Reamer Development



THE necessity of turning out war materials is so tremendous that new ways and means are sometimes developed almost by force. An interesting example is the line of small, ground flute reamers, made of high speed steel, recently introduced by Lavallee & Ide, Inc.

In 1941, J. A. Lavallee began making cutting tools for plants engaged in the defense program. As such plants increased and encountered more difficulties in obtaining perishable tools he, like many others, had to accept a quota of orders for reamers varying in diameter from $\frac{1}{32}$" to $\frac{5}{32}$".

These reamers were exceedingly difficult to produce. Although Mr. Lavallee and his associates were thoroughly experienced in this field, rejects in their own inspection department ran so high that, in spite of every effort, it was almost impossible to meet delivery schedules.

Mr. Lavallee decided to find some better method of making small reamers. The resulting reamers are made with the flutes ground in by specially designed machine tools. A tolerance of plus or minus .0001" is maintained throughout production and an accurate land, as narrow or as wide as the user desires, is left.

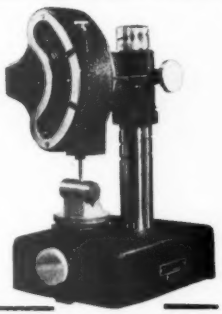
A constantly increasing number of war plants are now getting better reamers and getting them promptly. And after the war they will be available to peace-time plants.

Lavallee & Ide, Inc., Dept. A-3, Chicopee, Mass., will send more details.

AMIC COMPARATOR

★

A Precision Indicating Gage



Our extensive experience will solve your measuring problems

DESIGNED to replace special gages, flush pin gages, snap, height gages. For accurate, convenient and quick checking of components, either in the tool room or on the production line. Permits precise gaging throughout the whole day without eye fatigue. Each small line on the scale represents 1/10,000th of an inch.

A REMARKABLE IMPROVEMENT

Clear reading on 6" scale, with inch and millimeter readings. Magnification is 1000.

Measuring capacity is plus or minus .003" and plus or minus .05 mm.

Pointer immediately comes to rest.

Pointer moves in the plane of the scale, thus avoiding any error in measuring due to parallaxis.

Provision for convenient lifting of the contact pin.

Two fine adjustments for easy setting.

Convenient red mark limit hands control tolerances.

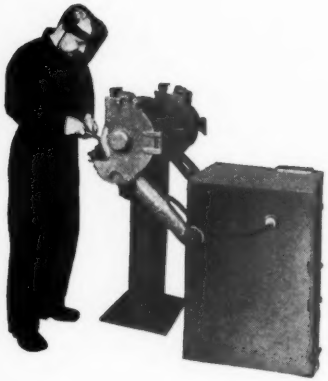
Interchangeable backstops and accessories.

AMERICAN MEASURING INSTRUMENTS CORP.

240 West 40th Street **New York, N. Y.**

MANUFACTURERS OF

GAGES, JIGS, FIXTURES AND SERVICE TOOLS



Torit Dust Collectors
One Unit Ventilators

A GOOD bet for shops where disposal of dust from certain machines can solve much of the general ventilation problem or where central suction systems need additional isolated aid are the Torit dust collectors. Self-contained units to carry away dust-laden air around polishing and grinding wheels, they are portable and can be placed wherever convenient near grinding or polishing wheels.

Dust-laden air is drawn from hoods surrounding the wheels down through a compartment behind a dust-proof motor in the cabinets, then up through a series of chemically-treated, spark resistant cloth filter bags. Heavy particles fall into a tray beneath the bags, while light particles adhere to the outside of the filter bags. If desired the filtered air may be piped outside, or it is perfectly possible to recirculate it safely into the room, thus eliminating loss of heat.

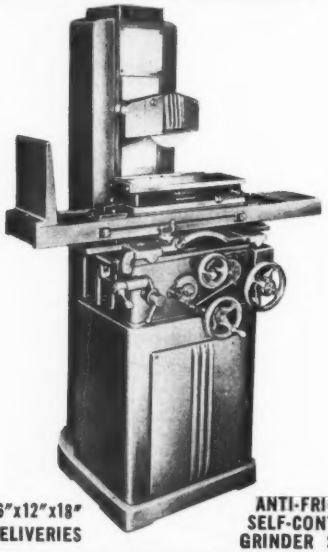
Economical and easily installed, these units are available in a number of different sizes, having capacities of from 240 to 1150 cfm, with new and larger models being developed. In some instances installation of several small Torit units has proven more practical than one small central system. The steel cabinet containing the motor, fan and filter bags may be placed wherever most convenient—or may be moved from one machine to another if desired.

Full particulars may be obtained by writing Torit Mfg. Co., Dept. T, 317 Walnut St., St. Paul, Minn.

ATLANTIC

No. 2 Automatic Precision

SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
GRINDER SPINDLE

ATLANTIC MACHINERY CORP.

149 Broadway New York, N. Y.

PUBLICATION PREVIEWS

Sales and Technical Literature

Send Request on Company Letterhead

MATCHING PARALLELS AND LATHE MANDRELS—are the subject of a broadside issued by Aget Corp., 615 Broadway, New York, N. Y. The parallels, made of steel, hardened and ground to close tolerances on four sides, are furnished in pairs only. The lathe mandrels, made in special sizes and up to 3" on demand, are also hardened tool steel.

C & W PRECISION CUTTING TOOLS—High speed special cutting tools made by the C & W Tool Co., 20 Chestnut St., Cambridge, Mass., are described in the company's new bulletin on these products. In general C & W makes special reamers, counterbores, countersinks, milling cutters, end mills, hollow mills, profile cutters, shaving tools, gun drills, etc., of high speed steel.

"INSTALLATION AND LEVELING OF THE LATHE"—is another in the series of bulletins on the care and operation of metal working lathes issued by the South Bend Lathe Works, Dept. 3-V, South Bend, Ind. Among the subjects described and illustrated are unpacking the lathe, illumination, floor layout, supporting and securing of the machine—all factors necessary for efficient operation. This bulletin (H-3), along with others in the series, may be secured free.

POWER BITS AND HAND DRIVERS—for Phillips Recessed Head Screws are covered in Catalog No. 15 of the Apex Machine & Tool Co., Dept. H, Dayton, Ohio. Potential purchasers of such tools will probably be interested, also, in the Apex Reconditioning Service, described on page three of the booklet.

CHICAGO MOUNTED WHEELS—for every polishing job behind the lines are easily chosen with the aid of a new selection guide, contained in this manufacturer's new booklet. Sixty-four pages are devoted to actual size photographs and complete specifications of the varied line of mounted wheels manufactured by the Chicago Wheel & Mfg. Co., 1101 Monroe St., Dept. TD, Chicago, Ill.

"DUST COLLECTING SYSTEMS IN METAL INDUSTRIES"—shows the effectiveness of installing such systems as an aid to human efficiency and for the protection, also, of motors, bearings and other working parts of equipment. Issued by the Kirk & Blum Mfg. Co., Dept. J-5, Cincinnati, O., the booklet shows this company's systems in operation in various types of metal working industries.

RAWHIDE IN UNUSUAL ROLES—as well as in its regular use for hammers, belting, packings, and the like is described in a catalog issued by Chicago Rawhide Mfg. Co., 1280 Elston Ave., Chicago, Ill. Rawhide gears and pinions and rawhide used as protective boots for lubricated contact surfaces which need protection from dust, grit, sand and water will interest many readers.

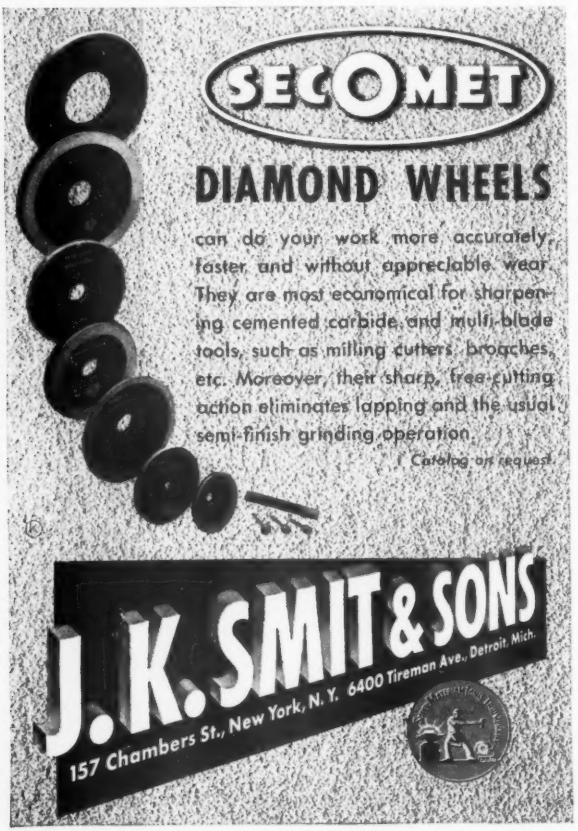
FIRTHITE TOOLS—This super-hard sintered carbide type of tools is described in a 38-page catalog of the Firth-Sterling Steel Co., Dept. 3-C, McKeesport, Pa. Selection of Firthite tools and their place in every shop takes up the first few pages and the rest of the booklet is devoted to standard and non-standard tools, drills, bits, wear-resisting parts and the like.

"WHERE DOES 'RACINE' FIT INTO THE HYDRAULIC FIELD?"—asks the new booklet put out by this well-known tool and machine company. The answer is given, and Racine pumps, valves and controls described in the process, in Catalog No. P-10-C, available from Racine Tool & Machine Co., Dept. C-13, Racine, Wis.

CERROMATRIX — a low-temperature-melting alloy put out by the Cerro de Pasco Copper Corp., is the subject of a new manual of value to plants who wish to save time on intricate punch and die production problems. Cerromatrix, poured around the dies, eliminates the need for complicated holding devices and makes unnecessary hours of machining non-working surfaces to close dimensions. Copies of this manual may be obtained from Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.

MACHINE TOOL BUYING GUIDE—Packed with an unusually large amount of engineering specifications, the new Cincinnati Milling and Grinding Machines, Inc., catalog presents their complete line of milling, grinding, broaching and lapping machines. In addition to full descriptions of each machine, spindle speeds, table feeds, ranges, and similar details are all included. Copies are available from the Cincinnati Milling & Grinding Machines, Inc., Dept. T-J, Cincinnati, Ohio.

"IN WAR TIME TEMPO"—This new booklet put out by Reiner Machinery Corp. is described as a listing of means to speed up production. Such Reiner products as vises, surfacers, vertical milling machines and lathes are included. Copies of the booklet are available from this company at 520 Fifth Ave., New York, N. Y.


SECOMET
DIAMOND WHEELS
can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.
Catalog on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

WYCO RADIAL TYPE FLEXIBLE SHAFT MACHINES—for use where suspension type machines are difficult to hang and where floor or bench machines would be in the way of the operator are illustrated in a broadside issued by Wyzenbeek & Staff, Inc., 841 W. Hubbard St., Chicago, Ill. The manufacturer will supply more details upon request.

"'SPEED CASE' PRESENTS ITS CASE"—in Bulletin No. 942 of the W. J. Holliday & Co., just off the press. Describing a new process embodying both chemical and temperature controls for the production of low carbon open hearth case carburizing steel, the bulletin tells how "Speed Case" was developed to meet the need for a steel with machinability of S.A.E. 1112 and X1112 Bessemer screw stock and the strength of such open hearth steels as S.A.E. 1020, X1020, X1314 and X1315. For copies write to W. J. Holliday & Co., Dept. H, Indianapolis, Ind.

METAL BONDED DIAMOND WHEELS—Diamond concentration is pointed out as the best characteristic of these wheels, described in a broadside issued by Dia-Tool, Inc., Dept. C-2, Yonkers, N. Y. Recommendations for their use as well as facts about their grit size, thickness, diameters, etc., are included.

"HOW TO LOWER DIE COSTS"—is the title of a pamphlet available upon request from Dept. H-2, Moore Special Tool Co., Inc., Bridgeport, Conn. Thirty-one points, all perhaps familiar to the experienced diemaker but invaluable as a reference or reminder in the hands of the designer, diemaker and inspector, show the way to increase die life and eliminate die failures, thus reducing ultimate die costs.

TRITON DIAL INDICATOR GAGES—and cylindrical plug gages are described in the latest bulletin issued by The Triton Precision Corp., 1300 Inwood Ave., New York, N. Y. Made to American gage design standards unless otherwise specified, prices and specifications on Triton gages will be furnished by the company upon inquiry.

"POWER PRESS PROTECTION"—a valuable little booklet on the operation, maintenance and supervision of press operations is a publication many Tool & Die Readers will be interested in requesting from the Junkin Safety Appliance Co., Dept. 5-J, 10th and Hill Sts., Louisville, Ky. Besides discussing such apparent safety measures as guards, the booklet also discusses selection of personnel, lighting and similar safety companions.

JIG BORING ON A MILLER—is possible with the vernier attachment for Bridgeport Turret Milling Machines. Easy to apply and quickly removable, the attachment provides the same accuracy on this miller as is possible with a jig borer costing several times more. Write Nichol Machinery Co., 629 N. 7th St., Milwaukee, Wis., for diagrams and details.

SMIT DIAMONDS—New price lists are included in the latest copies of the J. K. Smit & Sons, Inc. booklet on "How to Use Internal Grinding Diamond Wheels for Cartridge Dies." Simple precautions for the use of Secomet Diamond Wheels in the finishing of Tungsten Steel Cartridge Dies are pointed out in the handy-size bulletin. Copies can be secured from Smit at 156 Chambers St., New York, N. Y.

GEARED HEAD LATHES—Three new bulletins (158, 159, 162) put out by the Springfield Machine Tool Co., Dept. J-1, Springfield, O., not only describe but also clearly illustrate

(Continued on Page 168)

★ ★ ★ ★ ★ ★ ★ ★

SPECIFICATIONS

1. Swing Over Bed, 10"
2. Bed Length, 43⅛"
3. Spindle Hole, 25/32" Capacity, ⅝"
4. Preloaded Precision Ball Bearing Spindle Mounting
5. 12 Spindle Speeds, 30 to 1450 R. P. M.
6. Cross Slide Stroke, 3¼"
7. Six Position, Automatic Indexing Turret
8. Stroke of Turret, 4¼"

★ ★ ★ ★ ★ ★ ★ ★

No. 850 Logan Manufacturing Turret Lathe

Logan Speed Collet Chuck for the No. 850 Lathe or others with a 1½" x 8-thread spindle nose. Capacity: ⅝" round bar stock. Quick acting. Positive squeeze grip actuated by plastic hand wheel. No keys or wrenches

AN ACCURATE TURRET LATHE FOR SMALL PARTS PRODUCTION

Developed to meet war industry's urgent need for a fine tool capable of continuous production with sustained accuracy, the No. 850 Logan Turret Lathe has surpassed all expectations. Within the limits of its capacity (⅝" round bar stock) it will turn out parts with the same precision, and with equal or greater speed as that of heavier equipment, which can be released for larger work. And, of course, the investment and operating costs are proportionate to its size. *Complete description and specifications on request.*

Logan

LOGAN ENGINEERING COMPANY • Chicago

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

(Continued from Page 167)

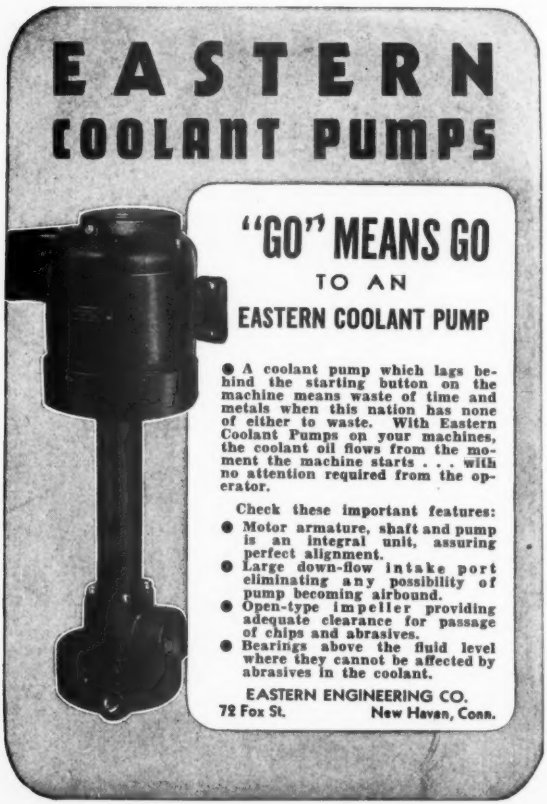
all moving parts on each of several lathe models. Extremely complete specifications included in these bulletins—which can be secured from the company—leave no questions in the machine tool user's mind as to the characteristics of each machine.

SPOT WELDERS—of almost any type are available from the Eisler Engineering Co., Inc., 753 S. 13th St., Newark, N. J. Details of these machines are presented in a catalog put out by this company. Also described in the catalog is Eisler's job welding department, available for firms whose production does not justify purchase of a spot welder.

ACCIDENT PREVENTION—Equipment to save lives and prevent injury is the contribution to the war program by the Boyer-Campbell Co., 6543 Antoine St., Detroit, Mich. In its new Catalog 50, it illustrates and describes everything from "Armored" hand pads and respirators to safety bulletins.

MORE THAN A CATALOG—Fulflo's new book on pumps and valves is not so much of a catalog as it is a compilation of data on coolant pumps and valves with mechanical drawings of each model. As such, they are of particular interest to engineers and will be sent on request to the Fulflo Specialties Co., Inc., Dept. T-J4, Blanchester, O.

QUICK SETUPS—are pointed out as the advantage of the new Johnson Metal Cut-Off Band Saw, described in a new bulletin by its manufacturer. Especially valuable where "green" labor is employed, unskilled hands can use the machine after a relatively short instruction period. More complete details can be obtained by writing Johnson Mfg. Corp., 5001 Chrysler Bldg., New York, N. Y.


EASTERN
COOLANT PUMPS
"GO" MEANS GO
TO AN
EASTERN COOLANT PUMP
● A coolant pump which lags behind the starting button on the machine means waste of time and metals when this nation has none of either to waste. With Eastern Coolant Pumps on your machines, the coolant oil flows from the moment the machine starts . . . with no attention required from the operator.
Check these important features:
● Motor armature, shaft and pump is an integral unit, assuring perfect alignment.
● Large down-flow intake port eliminating any possibility of pump becoming airbound.
● Open-type impeller providing adequate clearance for passage of chips and abrasives.
● Bearings above the fluid level where they cannot be affected by abrasives in the coolant.
EASTERN ENGINEERING CO.
72 Fox St. New Haven, Conn.

MICROFINISHING—Use of the Hydrohoner for microfinishing parts ½" to 2" diameter in high production is demonstrated in the bulletin of the Micromatic Hone Corp., 1344 E. Milwaukee Ave., Detroit, Mich. Specific examples of Hydrohoner models at work, illustrations of complete machines and the products they finish are included. Tools, fixtures and abrasives have a small section on the final page.

ALLOY STEEL USERS—will find the new Ryerson book on NE (National Emergency) Steels valuable, particularly because of its step by step explanation of the Jominy End Quench Hardenability Test. In addition various NE Steels are listed as suggested alternates for standard compositions in the carburizing, medium hardening and high hardening groups. Joseph T. Ryerson & Son, Inc., Dept. 5-TJ, will furnish copies on request.

TOGGLE ACTION CLAMPING TOOLS—and their part in speeding up production is the subject of a new catalog issued by Knu-Vise, Inc. Pointing out that drilling, fabricating, assembling, welding and all such operations cannot be performed unless parts are held in position, the catalog goes on to show how—with such clamping tools—fastening and releasing work is reduced to the simple action of flipping a lever. Knu-Vise, Inc., 1330 Plum Ave., Detroit, Mich., will send copies upon request.

HOLDING OR INDEXING WORK—on machine tools is the subject of a new bulletin issued by Zagar Tool, Inc., Dept. D-1, 23880 Lakeland Blvd., Cleveland, O. Presenting the Zagar collet chucking fixture, the leaflet shows its use on the machines of various wartime concerns. Methods of reducing costs materially by handing second operations over to drill presses and Zagar Holding Fixtures are pointed out.

SPECIAL APPLICATION LATHES — Bulletin D-18 of the J. G. Blount Co., Dept. D-4, Everett, Mass., describes this company's special purpose lathes, pointing out their value for special operations. Various attachments, also described in the bulletin, increase the utility of these lathes, making it possible to efficiently and successfully handle many new types of work. Copies are available from the manufacturer.

RADIAL DRILL — A new radial drill, extremely simple in design yet with ample controls and flexibility to meet the needs of the more accurate jobs of production, is the theme of Bulletin 116 of Canedy-Otto Mfg. Co., Dept. H., Chicago Heights, Ill. Readers who write for this publication will receive more specific details on the drill's qualifications.

INDUSTRIAL DIAMONDS—that important companion of today's hurried grinding wheels in war plants is the subject of a small booklet which discusses their origin, classifications and use. Acme Diamond Tool Co., Dept. C, 15 Maiden Lane, New York, N. Y., has issued this booklet which also contains illustrations of some of the specially shaped diamond tools they build to specification.

A VARIETY OF GAGES—are described in a group of small leaflets issued by Frank E. Randall. Manufacturer of Randall & Stickney thickness, rubber jaw, watchmakers', upright jaw, universal, machinists' bench and other gages of varied use, Randall will be glad to furnish readers with these detailed pamphlets. Requests should be addressed to Frank E. Randall, 244 Ash St., Waltham, Mass.

Gaging Accuracy MULTIPLIED BY 2

DUBLIFE REVERSIBLE PLUG GAGES

The Gage dependable *for longest service* is essential to speed precision production. DUBLIFE Gages double the life of gage accuracy, with reversible ends, both "Go" and "No Go". Turn either end when worn, and you have a new gage. Plugs locked by bronze split collet in one handle. Sizes: .030 to 1" UPPCO lapped, enduring finish.

United Precision Catalog shows full line with complete data

Also other gages of American Gage Design. Write

UNITED PRECISION PRODUCTS CO.

3516 West Belmont Ave. Chicago, Ill.

Portable Coolant Pump Convenient, Sturdy

NEW and portable, the Eastern Model 16-x Coolant Pump (with tank), just announced by Eastern Engineering Co., is designed for use on lathes, shapers, grinders, etc., where a steady stream of coolant or cutting oil is necessary and where often coolant previously had to be applied by hand. Thus besides being convenient because of its portability it also helps conserve the use of tools.

Despite the fact that it is completely self-contained and can be quickly moved from one machine to another, it is husky enough that it can be installed as permanent equipment. Two models are available, one with flexible metal hose and control valve; the other for permanent mounting.

Made of cast iron, the pump itself is so designed that there is no metal to metal contact below the liquid level, thus making possible continuous and dependable handling of non-lubricating liquid.

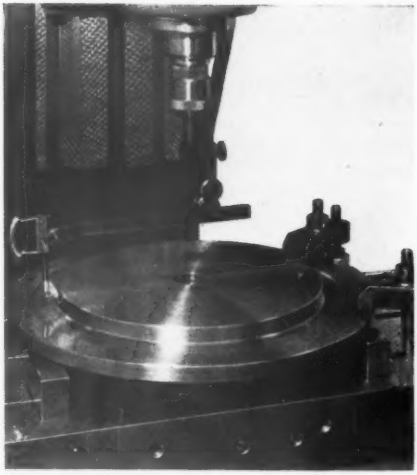
Tank size is 16" long x 10" wide x 9" high. Weight—40 lbs. Motor —1/30 HP, 1525 RPM, air jacketed, fan cooled, totally enclosed motor for operation on 110 volt, 60 cycle, 1 phase current. Pump is of the centrifugal type.

The subject of this month's Training For Victory section is "Shaper Technique".

Information will be supplied upon request to Eastern Engineering Co., 72 Fox St., New Haven, Conn.

Cartridge Case Dies
... WITH TALIDE NIBS made of Solid Tungsten Carbide, are producing millions of primer cups, small arms ammunition cases and jackets, and cartridge cases in sizes 20 m/m to 105 m/m with Better Finish, Longer Life, Closer Tolerance and Fewer Rejects ... including cupping, drawing, tapering, sizing and pointing operations.
TALIDE
METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO
TUNGSTEN CARBIDE TOOLS . DIES . WEAR PARTS

High Accuracy Possible With Oslund Devices



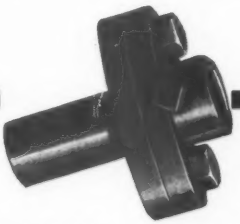
ACCURATE diameter readings up to 5" with the regular Oslund Holder for indicators and up to 15" with the extension bar used on this same device save setup time, according to the manufacturer. Equipped with two thumb screws, the holder eliminates tiresome tapping and cuts adjustment down to the simple, quick turn of a screw.

The operator first loosens the lock screw, moves the clamp until the indicator is in the approximate position and then tightens this screw. Then, for final adjustment, he simply turns the second screw—the Micro-Adjusting Screw—until the indicator reaches exact position.

In the view above, with the extension bar in use, it is possible to take indicator readings on diameters up to 15".

Available for all types of indicators, the Oslund Holder described above is particularly effective when used in conjunction with the Oslund Indicator, proven efficient by over 20 years of actual shop tests. It possesses a 360° reading face and eliminates the necessity for moving from position to read the scale. Entirely shock-proof, it does not lose its accuracy when accidentally pushed beyond the total travel of the pointer.

Complete information is available from Oslund Tool & Die Co., 14 Sigourney St., Hartford, Conn.



FLOATING HOLDERS for Screw Machines

Now Available for
IMMEDIATE DELIVERY
(In Stock)

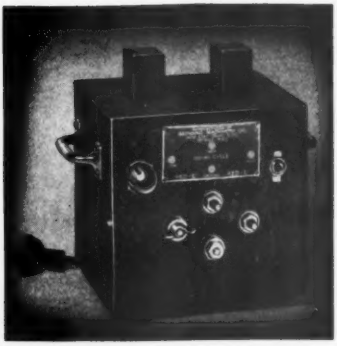
	Our No.	
B & S No. 00	No. 1	$6.00
B & S No. 0	No. 2	6.25
B & S No. 1	No. 3	7.95
B & S No. 2	No. 4	8.65

Made of Forged Steel
as developed by our Engineers

(Designers and Builders of Fine Machine Tools)

AJAX ENGINEERING & MFG. CO.
MANUFACTURERS OF HALCO PRODUCTS
14234 BIRWOOD AVE., DETROIT, MICH.

All-Purpose Etchers Made in Six Models



ACCORDING to their manufacturer, red "E" demagnetizers and etchers can handle all marking jobs as easily and quickly as writing with a pen. Six models, all portable, operate from any 110 volt, 60 cycle, A.C. outlet. Each model is equipped with red operating indicator light; carrying handles; sturdy, fast action switches; four rubber cushion feet and an ample length of non-kinking rubber connecting cord with plug.

The etchers have special, alloy tipped marking stylus, set in a self-cooling wooden handle with rubber insulated connecting cord.

Model "E" standard type demagnetizer and etcher, illustrated, operates on 60 cycle, 110 volt A.C. current from a regular electrical outlet. It quickly demagnetizes parts by passing them between or bringing them into contact with the two magnetic posts at the top of the unit.

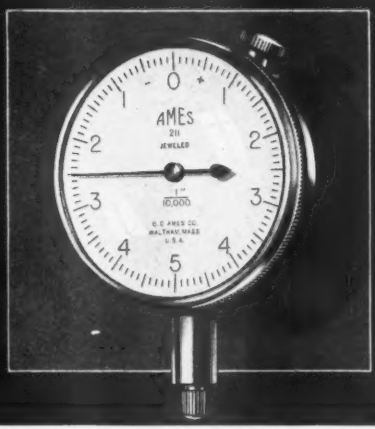
New! Informative! Useful!

The "Industrial Plastics" section now makes its appearance on page 115.

Three connecting terminals offer a selection of etch depths, preventing burning or show through on thin or lightweight parts. It weighs about 10 lbs. and measures 6½" x 5" x 6½".

More details on this model or on their other five models may be obtained from Grinding Machine Co., 2835 E. Grand Blvd., Detroit, Mich.

AMES *Hundred Series*
DIAL INDICATORS



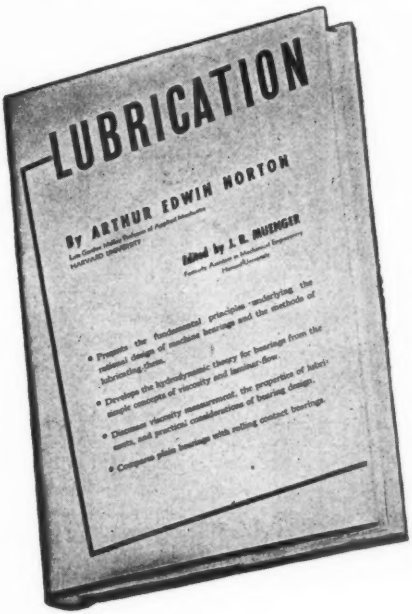
Made to A. G. D. specifications in four sizes with fourteen different dial numberings indicating thousandths, half and tenths of thousandths inches. Plain or jewel bearings. Shock absorbers for all models.

Send for new catalog No. 52

B. C. AMES CO., WALTHAM, MASS.

SHOP AIDS

"LUBRICATION"—This book on one of the most recently explored fields of modern production efficiency provides a text for the study of lubrication. Material for it was



originally compiled for classroom use by the late Prof. Arthur E. Norton of Harvard University and, on his death, the notes were completed and edited by his former assistant, J. R. Muenger.

The major part of the book is concerned with the hydrodynamic theory of bearings. Presented in straight-forward manner, the information is developed from the simple concepts of viscosity and equilibrium rather than from the differential equations of hydrodynamics for motion and equilibrium. Besides presenting the hydrodynamic theory, the book discusses the types of friction of interest in lubrication and gives criteria for bearings. A chapter is devoted to the properties of lubricants. The measurement and variation with temperature of viscosity is discussed at some length. For those who wish to intensify their study of this subject or any one of its phases, numerical examples of the solution of typical problems are found in the text and numerous references are listed in the Appendix. "Lubrication" is available through the Tool & Die Journal for $3.00.

ALIEN PATENTS—Nearly 50,000 patents, formerly owned by enemy states and their nationals and now the property of the Alien Property Custodian of the United States Government, are available for use, under license, by American industries. In "Patents at Work," a statement of policy of the Alien Property Custodian, the entire story of how these patents were taken over and under what conditions they may now be used is told. Promise is made that any manufacturer needing a license for any enemy-controlled patent which is essential for war production can get it within a few days.

These patents and patent applications have been listed by title under the standard Patent Office classifications. Lists are available through the Office of the Alien Property Custodian, Chicago, Ill., for ten cents (with the exception of a few of the larger classifications). Printed copies of the actual patents and patent drawings and specifications may be secured from the Commissioner of Patents, Washington, D. C., also for ten cents.

"MECHANICAL DRAWING" — Scarcely a clearer, more simple text for mechanical drawing students can be found than this book, originally written by Ervin Kenison, Prof. Emeritus of M.I.T., and James McKinney, educational director of the American School. It has just been revised and brought up to date by Tom C. Plumridge, head of the drafting and design department of the American School.

Nothing is taken for granted about the student's knowledge of this field. The very first chapter sets out to define the necessary qualifications of such things as tools, drawing paper, drawing boards, etc., T-squares, triangles, compasses — even pencils — are discussed in detail.

With this sound basis for further instruction, the book goes on to lettering, geometrical definitions and problems, projection, intersections, and the like, finally completing the text with chapters on isometric and oblique projection.

Nearly half the book is given over to problems and their solution, located directly after each section of reading material. Copies are available through the Tool & Die Journal for $2.00.

"DIE CASTING FOR ENGINEERS"—Put out by The New Jersey Zinc Co., 161 Front St., New York, N. Y., this book is more than a discussion of the place of zinc alloys in die casting—a metal working process now recognized as one of the leaders among modern high speed production methods. The editors have attempted rather to present an impartial analysis of all the many alloys in use, so that the engineer may make intelligent utilization of the inherent advantages of the process itself.

Realizing that die casting has only achieved its great growth in the past decade, the book treats the material clearly and simply. The history and growth of die casting itself is followed by a discussion of the principles and history of die casting machines.

Explanation of the use and importance of the six main alloys follow. Die construction elements, inspection and tests, jigs and fixtures for machining die castings and finishes and designs for die castings complete the book. Numerous illustrations and drawings make the book of value to the student as well as to the experienced engineer. The New Jersey Zinc Co. will send copies for $1.00 to Tool & Die Journal readers.

2 IDEAL
WAR PRODUCTION
SPEEDERS
IDEAL
LIVE
CENTERS
TAKE DEEPER CUTS
AT HIGHER SPEEDS
Get more work—quicker—out of lathes, millers, grinders, etc. IDEAL Live Centers rotate with the work.
Radial load carried by a high precision ball bearing, thrust load by a taper roller bearing. All parts hardened and ground.
TRIPLE DUTY
Save Set up Time with these three Interchangeable Center pieces. For all kinds of Centered and Uncentered Work. An exclusive IDEAL feature.
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METAL ETCHER
Prevent loss, theft and confusion by permanently marking identification on all smooth-surfaced tools, dies, metal parts and products with Ideal Metal Etcher. Complete; streamlined. Other models for fine or heavy duty etching. Most complete line of marking tools.
Permanently Marks Iron, Steel and Their Alloys
14
HEATS
115 to 1300 Watts. Low heats for fine lines on small, thin parts—high heats for bold lines on large, heavy parts.
FREE
Machine Tool Accessories Catalogue describes in detail these and other time and money saving products.
IDEAL COMMUTATOR DRESSER COMPANY
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Sycamore, Illinois
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd., Montreal, Quebec

CHIP BREAKER CHARTS—Another Kennametal publication, available free through McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa., this Chip Breaker Designs chart will be of interest to metal machining plants using carbide tools.

Dimensional diagrams for correct grinding of parallel, angular and groove type chip breakers are included as are photographs of the three chip breaker types and the kind of chips which will result from the use of each type of breaker.

In addition to precautionary instructions on chip breaker grinding, the charts project chip breaker dimensions for all three types in relation to depth of cut and feed of the operation to be made.

"PRACTICAL ARC WELDING"—by W. J. Chaffee is the second printing of this popular text book issued by Hobart Trade School, Inc. Its 516 pages are packed with detailed, yet simple information on all aspects of arc welding. The first 12 chapters, devoted to general information, include such subjects as where this skill is used, discussion of joints and welds, electrodes and filler rods, costs of arc welding, equipment, etc.

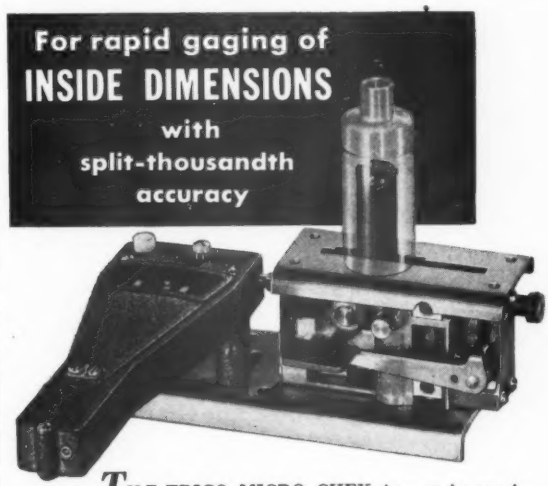
In Part Two, ten chapters go into definite step-by-step instructions called "The Operator Training Course." This text material is that used in the Hobart Trade School's own course. Sections on carbon arc welding and cutting, definitions of welding terms, tabulated data for operators and designers and an exceptionally complete alphabetical index complete the book.

Tops as a textbook for the beginning welder, the book's clear and brief discussions of all the phases of arc welding make it a good refresher book or reference manual for the old timer. Dozens of pictures and drawings make the text material even easier to understand. It can be secured for $2.00 from The Hobart Trade School, Inc., Dept. T-J, Box EW80, Troy, O.

"MEN, MACHINES AND MORALS"—Julian Street's fascinating little book, just issued by Denison University Press, is a picture of American industry's exciting period of development as well as the past 50 years of Cleveland's Osborn Co. under Pres. Franklin G. Smith.

Written in the interesting style of a modern novel, Street's book is the story of one successful purveyor of individual initiative and the company he built from eight employees and one machine to its present size. Told at the same time is the story of the United States' industrial and social progress from the real horse and buggy days to its streamlined today.

(Continued on Page 176)



THE TRICO MICRO-CHEK **is now in use in more than 2250 war plants to speed up nearly all types of precision gaging. Multiplies dimensions by 200—reducing eyestrain and fatigue.**

The new Caliper Type facilitates rapid gaging of internal dimensions, regardless of shape—from 3/16" to 2-1/2"—by means of expanding caliper fingers. Set up ready for use. Applicable to practically any recessed gaging need—replacing plug gages. Adjustable against wear.

TRICO

Write for illustrated booklet showing many applications of Micro-Cheks.

TRICO PRODUCTS CORP.
180 Trico Building, Buffalo, N. Y.

(Continued from Page 175)

"MOTION AND TIME STUDY"—This book is excellent either as a guide for the time-study engineer or as general information for the student of industrial relations. Prepared in detail, this second edition has been enlarged and two chapters added to illustrate the use of time values for combinations of therbligs in setting time standards.

Pointing out that time study and motion study are not two separate fields but must go hand in hand if efficiency is increased, the book discusses the origin of the two and their use in modern industry today.

Micromotion study is thoroughly discussed. Its two purposes are pointed out as (1) to assist in finding the most efficient method of doing work; and (2) to assist in training individuals to understand the meaning of motion study and, when the training is carried out with sufficient thoroughness, to enable them to become proficient in applying motion-economy principles.

All types of timing are discussed and such vastly different studies as packing candy, assembling waffle irons, and milling square heads on bolts used to illustrate the application of time standards.

Finally the use of training methods, both to bring new operators up to standard skills fast and to explain the use of time and motion study as a scientific aid to increased production—not as a speed-up—is covered in the last chapter.

Written by Ralph M. Barnes, the book is available for $3.75 through The Tool & Die Journal.

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— with Minimum Dimensional Loss!

Brightboy is distinguished from other abrasives by its resilient action; the *soft-rubber* binder *cushions* the abrasive. In use, the abrasive recedes into the binder, falling free as the rubber is worn away. This unique action enables Brightboy to bridge the gap between a grind and a buff — reducing operations and minimizing dimensional loss. In many instances, Brightboy does the desired work in one operation. This means GREATER PRODUCTION FOR YOU.

Available in wheels, sticks, blocks, rods and special shapes for manual and machine operations. Ask your mill supply house for catalog and prices, or write—

BRIGHTBOY INDUSTRIAL DIVISION

Weldon Roberts Rubber Co. **Newark, N. J., U. S. A.**

"KEEP YOUR LATHE IN TRIM"—fourth in the series on the care and use of turret lathes, this booklet issued by South Bend Lathe Works is of particular value today when machine tools must hold up longer—under the hands of inexperienced workers.

Among the many points covered in this 28-page booklet are the testing of motors and power supply, shortening, splicing and adjusting belts; testing and adjusting spindle bearings; and adjusting dovetail gibs. Full information is given on how to measure and adjust the setover of the tailstock top for realigning lathe centers and for taper turning. Photographs and line drawings are used to illustrate the various methods of making these adjustments.

Free copies of this bulletin (H-4) can be obtained from South Bend Lathe Works, Dept. T-J, South Bend, Ind.

"DOALL CONTOUR SAWS"—Reissued for the tenth time, this book published by the Do-All Service Co., Dept. T-J, 1201 Thacker St., Des

Plaines, Ill., is a textbook on contour saws.

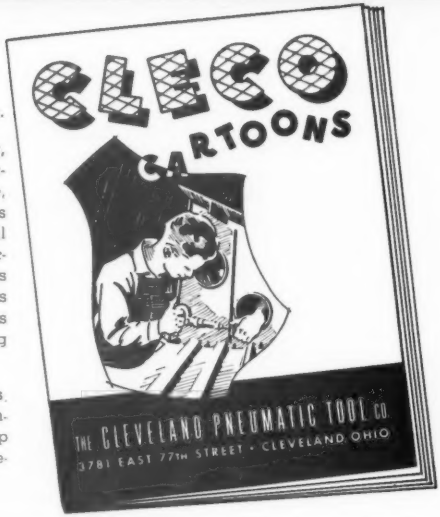
Part I, The Art of Contour Machining, compares contour sawing with other machine tools—the lathe, the milling machine, torch cutting methods, short run stampings and forgings, for instance. Basic Do-All applications are illustrated in the manufacture of dies, punches and die shoes, jigs and fixtures, special parts, templates, cams and other applications. Actual photographs of suggestions of ways to cut machining costs close this section.

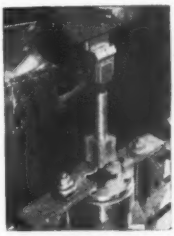
Part II, Precision Contour Saw Bands and Part III, A New Vocation (which recommends the opportunities of machine shop training to today's youth), take up the remainder of the book.

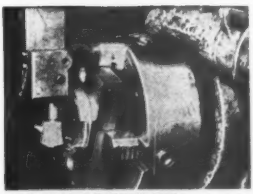
Many illustrations, including the famous Do-All Machine Tool Calendar are included.

MIDGET CUTTER GAGE—Offered free of charge to Tool & Die readers by Dept. A-TJ, Severance Tool Industries, Inc., Saginaw, Mich., this comprehensive midget cutter gage should prove helpful to purchasing and departmental heads as well as receiving and shipping departments and tool crib clerks. Printed on heavy cardboard in two colors this attractive die cut piece provides accurate measurements for tool diameters, radii, number of teeth per inch, angles of cutter teeth, decimal equivalents, recommended operating speeds for Midget Milling Cutters and other informative facts.

CLECO CARTOONS—present in humorous style the "do's" and "don'ts" of using pneumatic tools efficiently. Copies are obtainable from The Cleveland Pneumatic Tool Co., 3781 East 77th St., Cleveland, O.







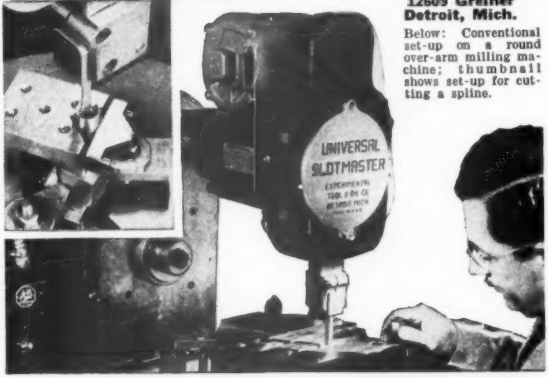
4 *of the many ways . . .*
SLOTMASTER *can be used to save* **TOOLS & SET-UPS**

Left: Set-up for lapping deep impression die.

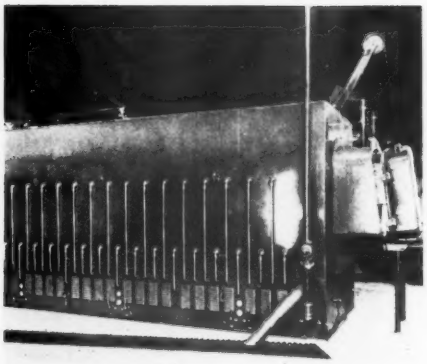
Below: Set-up for cutting an internal gear.

SLOTMASTER can be used on any round or flat-on-round over-arm milling machine and will do precision work that normally requires a multi-thousand dollar machine (all of the working parts are of tool steel, heat treated). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. The tool holder is of the clapper box type and can be turned in any position . . . SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc. . . . *Send for 4-page catalog—give specifications of the milling machines you wish to equip. Immediate deliveries on high priorities.*

EXPERIMENTAL TOOL & DIE COMPANY
12609 Greiner
Detroit, Mich.



Below: Conventional set-up on a round over-arm milling machine; thumbnail shows set-up for cutting a spline.



Whopper Furnace on 24-Hour War Work

CLEAN, bright work is obtained for one of the world's largest propeller manufacturers without cleaning, polishing or descaling operations with this giant Lithco chemically-neutral atmosphere furnace. Largest of its kind ever built, the furnace is now used 24 hours a day at this manufacturer's eastern plant. With overall dimensions of 8′ wide, 10′ high and 30′ long, its hourly capacity approximates 3,000 lbs.

Many problems of design had to be overcome to make this giant model as efficient as smaller ones. The muffle, 3′ wide, 3′ high and 25′ long, had to withstand working temperatures ranging from 900° to 2,100° F. An ingenious rail-roller system of support for the muffle was evolved to facilitate compensation for expansion and contraction. Sixty-six specially designed burners were required to insure even heat distribution through all areas of the massive muffle, yet 16″ insulation wall thicknesses confine the heat and contribute to the furnace's economy.

Like all other Lithco equipment, this product requires no atmosphere adjustments in order to obtain uniform decarb-free hardening regardless of the steel being used. The chemically neutral atmosphere nullifies any contaminating influences such as furnace gases, moisture, water vapors, etc.

The Lithium Corp., 114 Sylvan Ave., Newark, N. J.

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LIMA
MOTORS
LIMA PRODUCTS . . .
ENGINEERED for PERFORMANCE, DEPENDABILITY, and LONG LIFE . . .
MOTORS ½ to 75 H. P.
MAGNETIC POLISHING LATHES
BUILT-IN RECTIFIER FOR D C CURRENT
PEDESTAL GRINDERS
2 AND 3 H. P.
GEARSHIFT DRIVES
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Lima Products, engineered for precision applications, will continuously deliver full rated power performance under the most adverse operating conditions.
To serve American Industry, our field engineers have been specially trained in all phases of motive power application for machine tool and production equipment. Lima Products, plus Lima Engineering Service are the dependable answers to your motor or machine tool production problems.
Many exceptional features such as oversize shafts and bearings, dynamic balancing, heavy rugged frames, etc., are responsible for Lima's outstanding ability for long profitable life. Wire or write today for address of Lima Engineering Service nearest you.
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Send for new descriptive catalog showing the LIMA line.
Large enough to successfully serve you, yet small enough to give personal attention to your needs.
THE LIMA ELECTRIC MOTOR CO.
LIMA, O.
858 Findlay Road
U. S. A.

INDUSTRIAL DIGEST

(Continued from Page 130)

operation of company victory gardens are available through National Victory Garden Institute, 598 Madison Ave., New York City.

More firms have been honored by Army-Navy "E" awards. Winner of the coveted honor, February 25, was Whitman & Barnes (Division of United Drill & Tool Corp.) who was presented with the "E" flag in ceremonies at the Western High School auditorium, Detroit, Mich.

Varied Honors Reward Production

Preceding the ceremony a luncheon was given at the Book-Cadillac Hotel in honor of the many Army and Navy officers present. This was followed by an inspection tour through the plant. Here the visitors watched the manufacture of twist drills, reamers and allied cutting tools used in making war armaments of all descriptions.

* * *

For "fine achievement in the production of war equipment" Stokes Industries, Inc., Cincinnati, O., manufacturers of Sebastian Precision Lathes, received a similar award, March 26.

In accepting the award on behalf of the employees, Pres. Edw. E. Stokes pledged that his company would continue to give its best for even greater production records.

Guest speaker at the formal presentation ceremonies was the Hon. Keen Johnson, Governor of Kentucky.

* * *

Gilbert and Barker Mfg. Co. of West Springfield, Mass., makers of Gilbarco gasoline pumps, service station equipment and oil heating and air conditioning equipment, has been notified by Undersecretary of War Robt. Patterson that the company has won the Army-Navy Production Award for the second time. To designate this honor a white star has been added to Gilbert and Barker's "E" flag.

(Continued on Page 181)

C-F POSITIONERS

Speed Production and Job Welding

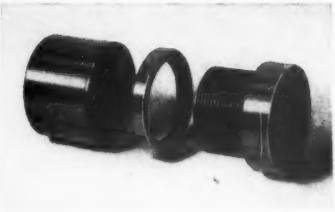
C-F Positioners make welding a faster and more economical operation—save time, save man-hours. The welder himself turns and tilts and positions even the clumsiest and heaviest weldments with a push button control—without cranes, crane crews, hoist, jacks or "flopping" space. All sides can be welded down-hand—all welds can be made faster with heavier rods; made stronger, smoother and flawless.

C-F Positioners come in sizes and types for every welding need—range from small hand operated units for light job work to giant positioners that swing great weldments weighing 30,000 lbs. All have platforms that rotate the full 360° and tilt to 135° beyond horizontal. *All are adjustable for height and are pedestal mounted to give greatest floor clearance.*

Write for Bulletin WP 22

CULLEN-FRIESTEDT CO.,
1316 S. KILBOURN AVE. CHICAGO, ILLINOIS

HERE'S *Extra* PRODUCTION TIME

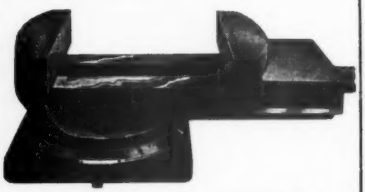


FOR MEN— *and* MACHINES

HOURS of precious time are saved by setting up straddle-milling jobs with Rousselle Adjustable Spacers. Slip the Rousselle onto the arbor, together with conventional spacers, screw to setting required, twist inner ring to lock into position. Grinding and set-up time are saved for *productive* work. Two lengths of Spacers fit all standard arbor diameters from ¾" to 4" bore. Special sizes available. Precision guaranteed to .001". Write for bulletin TD 33 and prices.

ROUSSELLE VICTORY VISE

A *big* precision vise for the big jobs. Made in 4½", 7", 10" and 13" jaw capacities. Write for Bulletin TD 43 and prices.



PROMPT DELIVERY—Priority Certification Must Accompany Orders. Dealers: Write for Dealership Plan.

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BENTON HARBOR, MICH.

PROMPT DELIVERY FOR *Victory!*

GALTER
HIGH GRADE TOOLS

DEPENDABLE PERFORMANCE
Guaranteed

- Plain Milling Cutters
- Side and Face Milling Cutters
- Stagger Tooth Side Milling Cutters
- Shell End Mills
- T-Slot Cutters
- Taper Shank Cutters
- Spiral End Mills
- Counterbores
- Countersinks
- Reamers
- Hollow Mills
- Drills

★

At Your Service for Special Tools, Dies, Jigs And Fixtures Made To Your Exacting Requirements

Write for prices on standard sizes or submit blueprints for quotations on special sizes.

Galter Manufacturing Co.
711 W. Lake Street - Chicago, Ill.

INDUSTRIAL DIGEST

(Continued from Page 179)

This is the fifth year in which this firm has been engaged in war production, work on the first Navy contract having been started in June 1939, nearly three months before the German attack on Poland.

* * *

Winner of a different but equally important honor is the Sheffield Corp., Dayton, O., which has been awarded the 1942 trophy of the National Tool Builders Association for the greatest machine tool increase in fourth quarter shipments as compared to those of the third quarter.

National in scope, the award marks an increase in this company's dollar value of shipments for the fourth quarter of 224 percent at the same time it was also establishing new highs in precision measuring instruments and gage production.

The trophy, a bronze figure entitled "Spirit of American Labor" by Max Kalish, noted American sculptor, was originally offered by John S. Chaffee, former president of the Tool Builders' Association and now vice-chairman of the tool division of the WPB.

Howard M. Givens, Jr., has been manager of tool steel sales since 1941.

* * *

New name of Industrial Sheet Metal Works, Detroit, Mich., is the Industrial Equipment Corp. The company will continue to operate under the same management at the same address, 628 E. Forest Ave.

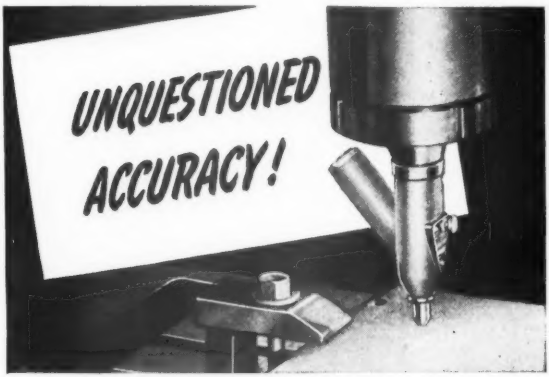
Established in 1929, the company today occupies an important position among manufacturers of dust collecting and spray booth equipment, as well as ovens and ventilating systems. Its best known development is its patented

(Continued on Page 183)

Headquarters for Allegheny Ludlum Steel

Here and There in Industry

Corp.'s tool steel sales offices have been moved to Dunkirk, N. Y., where this division's manufacturing operations are also located.



THE CENTER SCOPE IS AN OPTICAL LOCATING AND CENTERING TOOL—

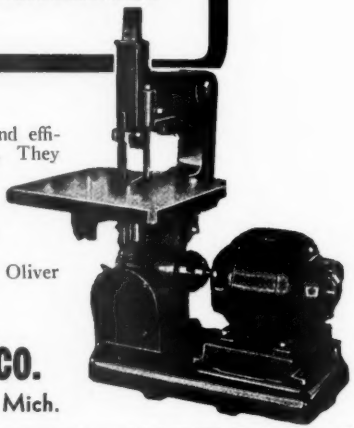
... whose accuracy is *unquestioned* at all times! It's a handy, rugged shop tool with 45X magnification that can be used directly on the job. With the Center Scope you can quickly and easily locate edges or layouts to a spindle axis within a tenth—set-up faster and easier and compensate for run out. With the Center Scope you can actually *see that you are right*—on every job, because the optical beam or line of sight is inflexible and cannot be distorted. On any machine—the Center Scope is the only instrument that gives you at all times visible assurance of accuracy. Write NOW for the new free 16-page catalog "Unquestioned Accuracy."

CENTER SCOPE INSTRUMENT COMPANY
351 SOUTH LA BREA AVENUE, LOS ANGELES, CALIFORNIA

Filing for Victory

with

OLIVER DIE MAKING MACHINES



Oliver Die Making Machines are fast and efficient on all sawing and filing operations. They save 50% to 60% of the labor over hand methods in the cost of making precision Dies, Gages, Cams, Templates and similar products requiring rapid and accurate sawing, filing and lapping operations.

It will pay you to investigate the line of Oliver Die Making Machines!

SEND FOR LITERATURE

OLIVER INSTRUMENT CO.

1436 Maumee St., E. Adrian, Mich.

In War, as in Peace . . .

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

REPRESENTATIVES AND DISTRIBUTORS

Brklyn., N. Y., Belmt. Smelt. & Ref. Wks.
Ansonia, Conn., Jackson Associates
Boston, Mass., Jackson Associates
Philadelphia, Pa., Castaloy Metal Sales Co.
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Chicago, Ill., Sterling Products Co., Inc.
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Minneapolis, Minn., Northern Machinery & Supply Co.
St. Louis, Mo., Metal Goods Corporation
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Montreal, Can., Dominian Merchants, Ltd.
London, Eng., Min. & Chem. Prod., Ltd.

CERRO DE PASCO COPPER CORPORATION

40 WALL STREET - - - - NEW YORK, N. Y.

INDUSTRIAL DIGEST

(Continued from Page 181)

Hydro-Whirl Dust Collector.

* * *

With a view toward stimulating fine precision workmanship in vital war production parts and maintaining quality as the keynote of its post war plans, the C. M. Smillie Co. recently inaugurated the Smillie Precision Award for its employees. The Award, an attractively designed lapel pin featuring the victory "V" set in the center of an American Eagle's spreading wings with the Smillie name across the bottom, is based not only on individual workmanship results but also on the "teamwork" spirit displayed. It is being featured in all Smillie advertising.

J. Russell Duncan, secretary of Peerless Machine Co., Racine, Wis., has recently added to his duties those of general manager of the same company. He is a member of the Association of Cost Accountants and is on the Board of Directors of the Ben-Hur Mfg. Co., Milwaukee, Wis.

* * *

Darwin & Milner, Inc., Cleveland, O., tool steel specialists who were the first to introduce high-carbon, high-chrome steels, have appointed Robt. A. Bell, formerly with the Superior Steel Corp., Carnegie, Pa., as manager of sales.

* * *

New Service Manager of the Tocco electrical induction heating and hardening equipment division of the Ohio Crankshaft Co. of Cleveland is Bernard F. Nemerguth. Formerly chief test engineer, Nemerguth has been with Ohio Crankshaft for over three years. An electrical engineer, he had previously been with the Cleveland Illuminating Co. and Dracco Corp. He will be in charge of all Tocco Service problems.

* * *

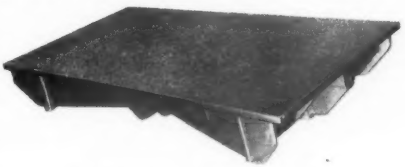
Death of C. G. Gilbert, manager of the Detroit office of the Federal Products Corp., January 28, ended a 22-year association with this company. Aged 60, his death followed a heart attack and a short illness.

The Mark of Quality

SWANSON
TOOL AND MACHINE CORPORATION, ERIE, PA.

Since 1919

SCRAPED SURFACE PLATES



MADE IN 24 DIFFERENT SIZES UP TO 36" x 60"

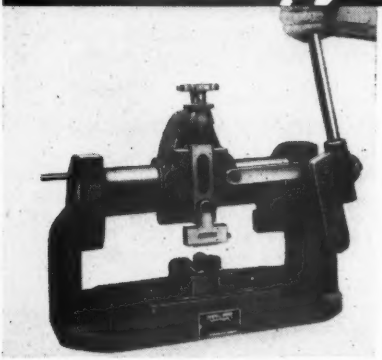
- Properly designed.
- Made from proven material, properly stabilized to prevent distortion and to outwear ordinary iron.
- Made to the most exacting standards that insure the highest degree of accuracy obtainable in any plate.
- More bearing per square inch for less cost.

"You Can't Buy a Better Surface Plate"

SWANSON TOOL & MACHINE CORPORATION

818 EAST EIGHTH STREET • ERIE, PENNSYLVANIA

PARTS MARKING MACHINES
..Sturdy, fast, efficient!



FOR CLEAR, ACCURATE AND FAST MARKING OF UNHARDENED STEEL, IRON, BRASS AND OTHER METALS AND MATERIALS.

The No. 9A ACROMARK Marking Machines are especially suited for shells, shot, tubular and cylindrical parts and pieces, including taps, drills, end mills, machine parts and other components where neat, fast marking is essential. Operation is simple and easy. At a pull of the lever, a uniform mark of any desired depth is made, and another part is marked on the return stroke.

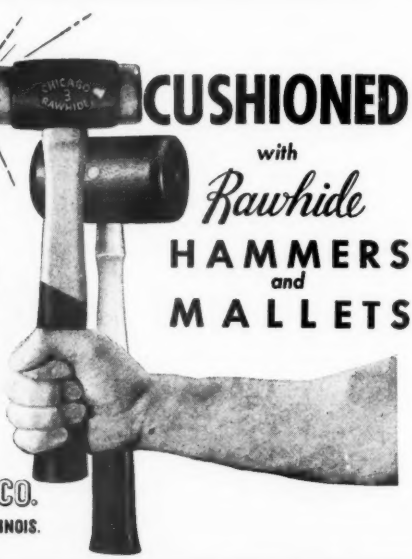
When volume production is required, the motorized No. 9AM Machine is used. This unit can operate at any set speed to suit the operator.

ACROMARK

Special machines for any size or production need can be built to specification. Inquiries invited.

THE ACROMARK COMPANY
515 MORRELL STREET, ELIZABETH, NEW JERSEY

BLOWS CUSHIONED
with Rawhide HAMMERS and MALLETS

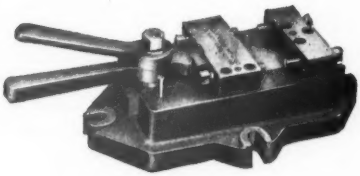


- Coiled Rawhide faces strike effective blows without marring or battering; speed up work; reduce spoilage. Hold true faces—strike accurately. Outlast several ordinary mallets. Reduce bounce and recoil—prevent fatigue. All sizes with light or weighted heads. Write for Catalog.

CHICAGO Rawhide MFG. CO.
1280 ELSTON AVE. ★ CHICAGO, ILLINOIS.

Quick-Acting Vise Speeds Vital War Work

WITH today's motto, "America Has No Corner on Time," as inspiration, Fenn Mfg. Co. advances its quick-action vise as a real contribution to the war effort. Not a fly-by-night idea, the Fenn vise has demonstrated its capacity for fast, dependable service in America's industrial plants for over 20 years. And its believe-it-or-not record is "no complaints as to workmanship or performance" in all those years.



Complete specifications will be furnished by The Fenn Mfg. Co., Dept. H-1, Hartford, Conn.

Its outstanding advantage—today and in less hurried times—is its time-saving, easy-operating method of holding a piece of work securely and rigidly during any number of machine operations.

Instead of using slow hand cranking to close the vise jaws on the material, the operator of a Fenn vise throws the jaws together instantly, uniformly, and solidly with a quick-action cam lever. To make the work doubly secure the eccentric handle then locks it in. Moreover, there is no unevenness to its grip. Just how uniformly the jaws of this vise come together when they take hold is graphically demonstrated by clamping two pieces of paper—.001" in thickness—one at each end of the jaws. The grip is even on both pieces of paper.

Swivel jaw type vises can also be made to customer's orders.

Hammond

CARBIDE TOOL GRINDERS

NEW 6"

BELTED MODEL

For fast and accurate silicon carbide or diamond wheel grinding the new Hammond Model 6-B Carbide Tool Grinder is multi V-belt driven. V-belt drive plus precision spindle dampens motor vibration and provides true, smooth running wheels. Wheels wear longer and grind faster because the Hammond 6-B gives you velvet-smooth operation. Write for Bulletin No. 202.

ANY ELECTRICAL SPECIFICATIONS AVAILABLE

Hammond Machinery Builders INC.

KALAMAZOO, MICHIGAN

1631 DOUGLAS AVENUE

EASTERN BRANCH - 71 WEST 23rd STREET, NEW YORK, N. Y.

ALL OUT WAR PRODUCTION* for UNCLE SAM

* Drill Jig Bushings
Optical Flats
Monochromatic Lamps
Plain Plug and Ring Gages
Contract Flat Lapping

ACME INDUSTRIAL COMPANY

Makers of Hardened and Ground Precision Parts

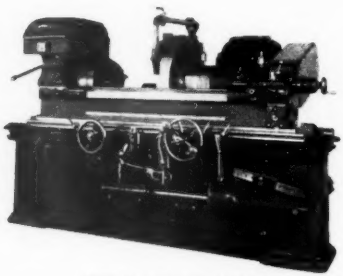
206 N. Laflin St. Chicago, Ill. MONroe 4122

HILL-CLARKE

Modernized

CYLINDRICAL GRINDERS

for **SUPER-GRINDING**
and **MICRO-FINISH**



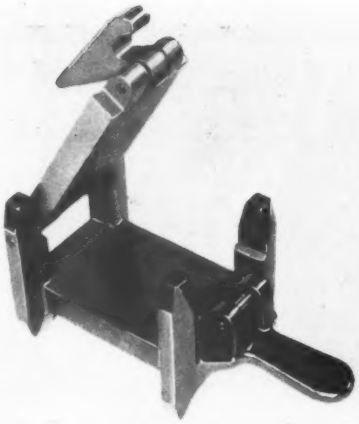
Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."

SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

HILL-CLARKE MACHINERY CO.
646 WASHINGTON BOULEVARD CHICAGO, ILL.

Basic Drill Jig Real Time-Saver



A TIME-SAVER for tool designer, tool maker and production man, the Parlec Universal Drill Jig, a new type basic drill jig unit, has been put on the market by Earl C. Parkhurst.

The tool maker or driller is able to get into operation many hours sooner than otherwise because he has only to finish the base for location of parts to be drilled, add side plates if drilling sides, and add bushings and clamping, and the jig is ready for production.

Sturdily constructed of cast nickel iron and normalized, its top, bottom and both sides are already finished. Man hours are saved, too, for the tool designer who can use the master layout furnished with each order. (The Parlec Universal Drill Jig is made in seven standard sizes.) This layout can be placed under drawing paper and the part to be drilled drawn in pencil, showing at once which size jig to use.

Finally its simplicity of design—only three castings and four pins and a special quick opening and locking device—saves time in production drilling.

Parlec Universal Jig cover sizes are: 1½" x 2", 3" x 3½", 3½" x 5¾", 6" x 6", 5" x 10", 1½" x 6", and 3" x 11". Special sizes and heights will also be furnished on request.

Full details are available from Earl C. Parkhurst, 749 E. Stepney Place, Inglewood, Calif.

Immediate delivery from stock

- **Collet Model 3AT & Drawbars for ATLAS and LOGAN 10" Lathes**
- **Collet Model 480 for new Logan Screw Machine & Turret Lathe**
  (Same as Warner & Swasey No. 1)
- **Drawbars for 9" South Bend**

Precision Collets and Drawbars

Of importance far beyond their size or dollar value, Collets and Drawbars are vitally needed on the production line and in the tool room. Our ability to deliver immediately from stock during war-time . . . and to deliver with no sacrifice in accuracy, is rapidly giving the *Precision* name an honored place in industry.

When collet work is indicated, specify *Precision*. Your dealer can supply you with these unconditionally guaranteed, longer lasting products. *Literature on request.*

GENERAL DIE—STAMPING—TOOL COMPANY
PRECISION COLLET DIVISION • 265 Canal Street, New York City

EVERY SMITH SURFACE PLATE IS A *Master* PLATE

Every Smith Surface Plate is a true Master Plate for close tolerance assembly and inspection. Scientifically designed. Precision built. On specifications requiring a total flatness tolerance of one ten-thousandths of an inch, medium size Smith Surface Plates have successfully met the test to the entire satisfaction of hard-to-please users. Tolerance on larger plates in proportion. Prompt delivery on standard sizes ranging from 8" x 12" to 48" x 96". For prices and delivery write, phone or wire.

★ ★ ★ ★

SMITH TOOL & ENGINEERING CO.

858 N. SANDUSKY AVE., BUCYRUS, OHIO

PRECISION MEASURING EQUIPMENT

Valuable Booklet Available

Forgings For All Industries
Rough Turned or Finished Complete

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Composite Die Sections Extrusion Tools
Crankshaft Forgings Gear Forgings
Die Casting Dies

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Rings, Discs, Blocks, Shafts, Hubs,
Bars, and Special Shapes.
Tool Steel of all Makes

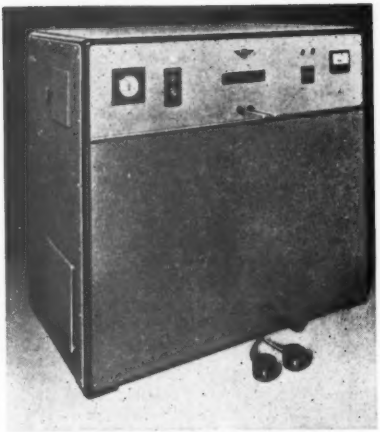
S.A.E. and NE Specifications
STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL AND FORGE Co.

205 ADAIR STREET DETROIT, MICHIGAN

Induction Heating Found More Useful Daily



INDUCTION heating, baby of war production years, is fast becoming an important development in the metal-heating field.

Starting only a few years ago with one or two isolated uses, induction heating has progressed mainly because it enables the manufacturer to localize heat and harden a specific section of a part to the exact hardness wanted and to a pre-desired depth with practically no change in the structure of the unheated portion of the part. For instance one example given by the manufacturer shows how on one part the gear teeth were hardened to 52-55 Rockwell C, the eccentric surface — used to operate a pump plunger — was hardened to 60-62 Rockwell C, and the clutch teeth were hardened to 56-58 Rockwell C.

The process is one of seconds rather than minutes, and simple enough that the average shop man or woman can learn it. The operator simply connects the heating coil fixture required for the workpiece to the machine, then sets the proper heating and quenching cycles. Thus with duplicate conditions, each piece can be turned out with identical characteristics.

However, surface hardening is but one application for induction heating. Today, these units are being widely used for forging, annealing, brazing and soldering.

Van Norman Machine Tool Co., Dept. J, Springfield, Mass., will furnish more information.

DESSAU
Diamond Tools
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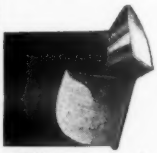
For over 102 years DESSAU has supplied industry with the finest in diamond tools for Cincinnati, Landis, Norton, Heald Machines, etc. Single diamonds and cluster diamond tools. Immediate delivery of all new and reset tools. Send at once for our latest catalogues, descriptive literature and prices.
MAURICE S. DESSAU CO.
Industrial Diamond Importers
Diamond Tool Manufacturers
535 FIFTH AVE. • NEW YORK, N. Y.
Dessau Diamonds True the Wheels of Industry

STYLE A — for general boring

STYLE B — for facing and bottoming



STYLE C — for internal threading

Grinding never changes form of

BOKUM BORING TOOLS

- Resharpening confined to one face
- Free cutting action always retained
- Tools stand greater feed
- Increased feed will not shatter tool

The angle of the cutting edge and the special helical backed-off form of the front of tool produces a free-cutting action unaffected by resharpening.

The greatest cutting force is always directed toward the largest cross section of the cutting tool, which enables tool to accept much more feed than is possible with any other boring tools.

Since the angle at which the tool removes material is not at right angles to the stock, a smoother bore, true to size, is always produced.

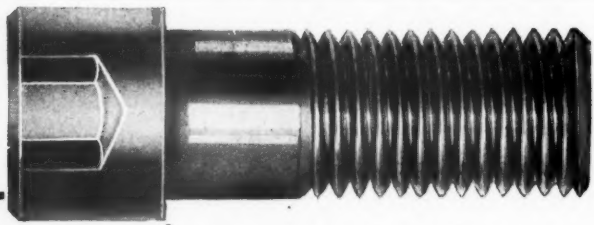
For super high speed steel tools, ask for Catalog E-1139.

For carbide tipped tools ask for Catalog E-398

All sizes shipped from stock

BOKUM TOOL CO.

14775 WILDEMERE AVENUE — DETROIT, MICH.



STRONG ACCURATE

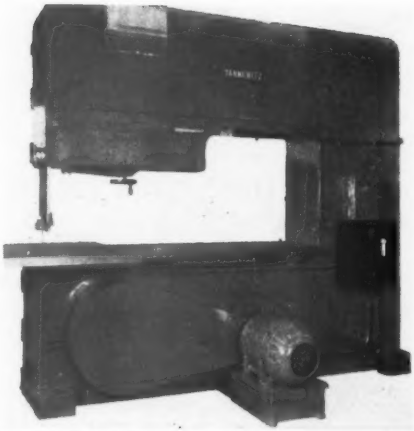
SAFETY "BLUE-DEVIL" CAP SCREWS

- Sturdy Cold-Formed Head with Unimpared Continuity of Fibres
- Precision-Formed Hexagon Socket with True Sides and No Taper
- Increased Solid Metal Section at Union of Head and Body
- Threads Die Cut — Accurate Class 3 Fit

CINCINNATI: WM. BUCHANAN SUPPLY CO., 339 E. 3rd ST.
YOUNGSTOWN: C. H. WILTSIE, 4177 OAK KNOLL DR.
ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

84″ Band Saw Handles Special Jobs



A SPECIAL 84″ band saw, made to order by the Tannewitz Works, will interest regular motorized saw users. A three-wheel construction is used to obtain the 84″ throat, and the machine is powered with a 15 hp motor and is belted to obtain a blade speed of 3600 feet per minute. Its brakes are synchronized two-wheel Lockheed hydraulic brakes which operate when the stop button is pressed and are automatic in case of emergency caused by blade breakage. The guides are the Paddock three-roller type.

Other features of this custom-built model include a 13″ capacity beneath the upper guide and the table, and a solid, non-tilting table with a large auxiliary table provided.

Manufacturers of a regular line of band and di-saws, Tannewitz from time to time builds special jobs such as this one, working with its customers on their individual requirements.

More usual are the 24″, 30″, 36″ and 42″ models. The three larger models are identical except for size, each being furnished with automatic hydraulic brakes for both wheels (the 24″ has only the lower wheel braked). The wheel construction on all four models is considered one of the most vitally important parts of the machines and is built exceptionally strong, yet light in weight and rigid and perfectly balanced.

Inquiries should be directed to The Tannewitz Works, Dept. D, Grand Rapids, Mich.

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

DIE TABLE Filing From Below

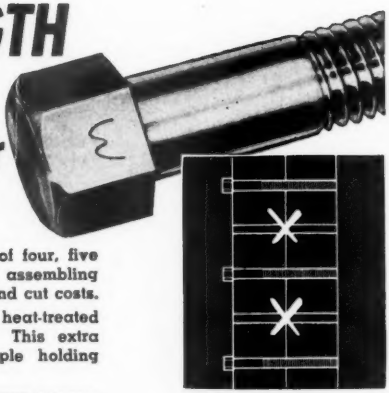
PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this Duplex Die and Punch Filing machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½″. Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
Exclusive Distributors
90 West Street New York, N. Y.

EXTRA STRENGTH
Can Save Time and Labor



When three screws can do the work of four, five or more, they save drilling, tapping and assembling time and labor. They speed production and cut costs.

Mac-it Hexagon Head Cap Screws are heat-treated for maximum strength and toughness. This extra strength can be used to provide ample holding power with fewer screws.

The Mac-it "m" on the hex head is your guarantee of quality. It appears on all diameters ¼" to ¾", inclusive.

OTHER MAC-IT PRODUCTS INCLUDE:
Hexagon Socket Cap Screws, Hollow Set Screws
Hollow Pipe Plugs, Stripper Bolts
Square Head Set Screws

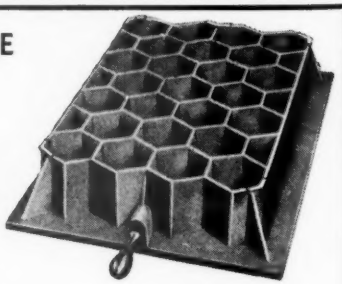
Mac-its
PRONOUNCED "MACK-IT"

Strong, Carlisle & Hammond Company • Cleveland, Ohio

THIS HONEYCOMB BASE IS THE PATTERN OF PRECISION

IN MEEHANITE METAL

SURFACE PLATES



Every factor contributing to accuracy has been incorporated into these surface plates. They are up to one-third heavier than any of the quality surface plates. The honeycomb design base distributes this weight evenly over the entire surface. Hand scraped to extremely close tolerances, of uniform texture, fine close grain, unusual strength and solidarity.

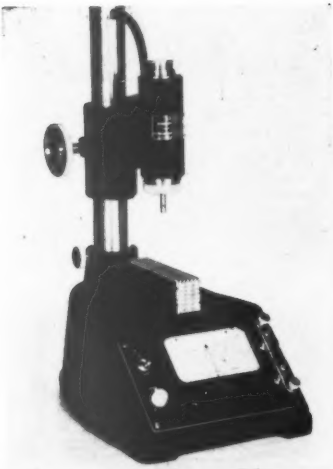
Other sizes to specification. Angle plates and straight edges of Meehanite metal also available. Good deliveries on most sizes. Write for folder.

Send today for Precision Production Tool Catalog No. 42

SIZES	APPROX. WT.	HEIGHT	TOLERANCE	NET PRICE
6 x 6	11 LBS.	2½"	.0001"	$ 19.00
8 x 12	38 "	3½"	.0001"	35.00
9 x 12	40 "	3½"	.0001"	35.00
12 x 12	50 "	3½"	.0001"	43.00
12 x 18	85 "	4"	.0001"	68.00
18 x 18	140 "	4½"	.0001"	98.00
18 x 24	200 "	5"	.0001"	133.00
18 x 36	310 "	6¼"	.0002"	174.00
20 x 30	325 "	5¼"	.00025"	190.50
24 x 24	334 "	6½"	.00025"	180.00
24 x 36	475 "	7"	.00025"	275.00
30 x 36	510 "	7"	.00025"	345.00
30 x 60	1425 "	10"	.00025"	596.50
31 x 78	2100 "	10"	.0003"	827.00
48 x 96	6000 "	12"	.0005"	1468.00
For Propeller Inspection: MEEHANITE METAL Ribbed Pattern 8 x 42	238 LBS.	6"	.0001"	$ 98.00
10 x 36	225 "	6"	.0001"	115.70

ACME TOOL COMPANY 200 CHURCH STREET NEW YORK, N. Y.

Electric Gage Makes Accurate Inspections



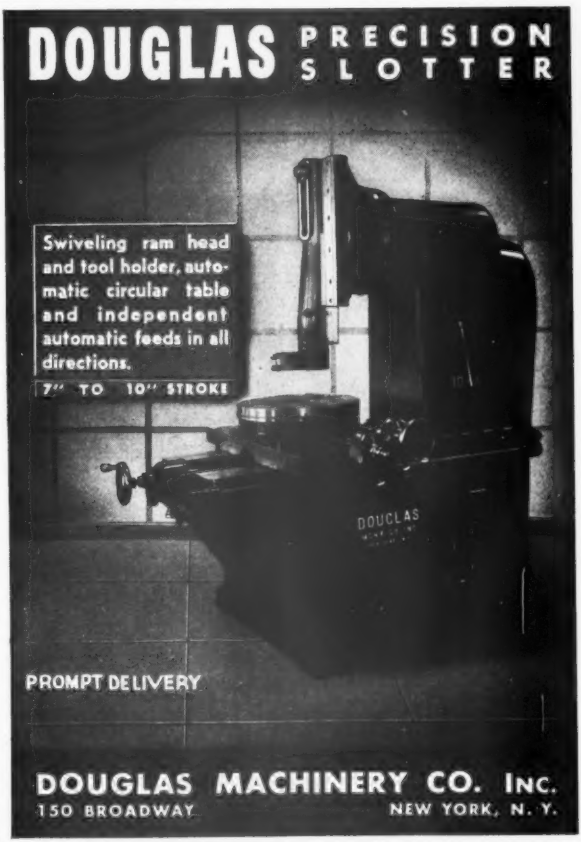
THE human element of "feel" is entirely eliminated and close tolerance inspections put on a scientific basis with a new electric comparator gage manufactured by Metron Instrument Co. Four ranges of sensitivity (from .00001" to .004" and special scales with higher magnifications and wider ranges possible if desired) particularly recommend this precision measuring instrument for the rapid comparison of close tolerance machined parts, for selective sorting of machined parts, for measuring taper and out of roundness, and for measuring shop tools and gages for accuracy and wear. Spindle pressure varies from two oz. to two lb.

The gage head swivels around the column and tilts at any angle to the vertical. This angle of tilt is indicated on a protractor.

The gage can be set to size in less than 20 seconds. To accomplish this, three size adjustments are provided, namely: a rack and pinion elevating mechanism, a vernier adjusting collar on the gage head, four revolutions of which move the spindle approximately $\frac{1}{2}$ of an inch, and the electrical zero adjustment on the indicating unit for hair-line zero setting.

The gage head and indicating unit are easily removable from the stand for use in special set-ups or in multiple gage fixtures.

Full information will be sent upon request by Metron Instrument Co., 435 Lincoln St., Denver, Col.


DOUGLAS PRECISION SLOTTER
Swiveling ram head and tool holder, automatic circular table and independent automatic feeds in all directions.
7" TO 10" STROKE
DOUGLAS
PROMPT DELIVERY
DOUGLAS MACHINERY CO. INC.
150 BROADWAY
NEW YORK, N. Y.

BETTER FINGERS INSTEAD OF BUTTER FINGERS

With *KNURLED*
SOCKET HEAD CAP SCREWS

UNBRAKO
Reg. U. S. Pat. Off.

The *knurling* of "UNBRAKO" Socket Head Cap Screws saves precious time—gears right to the fingers and prevents slip, lost time and motion. "UNBRAKO" Screws are precision made—have unbelievable strength—and are made in sizes #4 to 1½" dia.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 606
— BRANCHES —
BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

The KNURLING of Socket Screws originated with "Unbrako" years ago.

DI-ACRO Brake forms non-stock angles, channels or "Vees". Right or left hand operation. Folding width—Brake No. 1—6". Brake No. 2—12". Brake No. 3—18".

She's Fighting TOO!

Making Parts Without Dies

No delay waiting for dies—parts ready quicker—deliveries speeded up—all to bring the Victory sooner! Women are rapidly taking a major place on the industrial front. DI-ACRO Precision Shears, Brakes, Benders, are ideally suited for use by women in making duplicated parts accurate to .001"—DIE-LESS DUPLICATING. Thousands of DI-ACRO Machines are now in use in War plants. Get the whole story—write for catalog—"Metal Duplicating Without Dies."

O'NEIL-IRWIN DI-ACRO PRECISION MACHINES MFG. CO.
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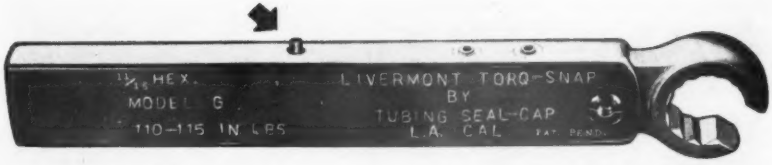

New Torque Wrench Eliminates Guessing

DESIGNED primarily for applying the proper torque load to tubing "B" nuts in aircraft plumbing, a new-snap-acting torque wrench has been developed which gives both an audible and physical signal when the proper predetermined torque load is reached.

The Livermont Torq-Snap, as it is called, was originally developed and tested by Tubing Seal-Cap, Inc., for use in aircraft plumbing by one of the country's largest aircraft manufacturers. It will eventually be available for a wide variety of additional uses such as engine base, cylinder head and connecting rod bolts, spark plugs, wing and break attach bolts and other bolts requiring a predetermined torque load.

Simple in design, it works on the principle of a spring bar deflection. The deflection in the main bar bends a second spring which snaps over center when the proper load for which the wrench is pre-set has been reached. This causes a slight drop in the torque curve, makes a "click" and actuates a "button" in the handle, giving a physical signal in the palm of the operator's hand. This double indication not only provides two warnings but also makes it practical to operate the wrench in restricted areas where indicators or dials could not be seen.

Twelve sizes will be available with open or box ends, either offset or straight.

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Application of Unit Drives To Machine Tools

(Continued from Page 86)

correct machine speeds, the importance of which cannot be overemphasized.

Production in a machine shop is materially affected by the cutting speed or operation speed of the machines. Naturally, every different size of piece being machined, every different material of which it is made, every different operation and every different cutting tool requires a specific speed if it is to operate at optimum efficiency. Table I includes some of the usual cutting speeds of various materials where different types of tools are used. Methods of obtaining the necessary speed variations are shown in Fig. 1 and Fig. 3.

Table I
Approximate Surface Speed for Turning with Various Tools

Material	High Speed Steel	Carbide
Cast Iron	60 fpm	200 fpm
Steel Cstg.	50	180
Bronze	130	600
Aluminum	400	800

Transferred into terms of revolutions per minute of the drill, some very interesting figures are obtained when tabulated as shown in Table 2 and Table 3. On these tables the linear speeds

Table II
Drilling Speeds for High Speed Steel Drills*

Drill Dia.	Bronze or Brass 300 fpm	Cast Iron Annealed 150 fpm	Mild Steel 100 fpm	Tool Steel 50 fpm
⅛"	9180	4590	3060	1530
¼	4590	2295	1530	765
½	2295	1148	765	383
1	1148	574	383	192
1½	861	430	286	143
2	574	287	192	96

referred to are the peripheral velocities of the drills. Interpolation from the sizes shown would give any intermediate values.

Table III

Drilling Speeds for Carbon Steel Drills*

Drill Dia.	Bronze or Brass 150 fpm	Cast Iron Annealed 75 fpm	Mild Steel 50 fpm	Tool Steel 25 fpm
⅛"	4590	2295	1530	765
¼	2295	1148	765	383
½	1148	574	383	192
1	574	287	192	96
1½	430	215	143	72
2	287	143	96	48

(Adapted from Machinery Handbook)

The above tables are presented with the thought of showing the necessity for a variety of speeds that are positive and are obtainable with a minimum of effort. With such a proper arrangement of cutting speeds, an increase in production is inevitable. Herein, therefore, lies the importance of unit drives because they make possible the necessary variety of speeds and make them very easy to obtain.

Brehm Trimming Dies

(Continued from Page 84)

the punch. The press stroke required for a shell includes the travel of the cams, the height of the untrimmed shell and the length of the gage. By using the gage as a loose part to be inserted into the shell by the operator before loading the die, the length of the required stroke can be shortened by an amount equal to the length of the gage.

Practically all shaped shells have been flat edge trimmed by Brehm Dies, from the smallest of ladies' wrist watch cases, to six and eight cubic foot electric refrigerator doors. Some shells have been trimmed with edges cut on an angle to the sides of the shell. Metal thicknesses have varied from .010" brass to .218" steel. Shells made from fibre, zinc, aluminum, copper, brass, steel and stainless steel have been trimmed.

Patents for a new fastening to attach removable engine cowlings on high speed military planes have been granted to Dr. Edward L. Mack, for ten years Director of Research and Development for the Reynolds Metal Co. Plans are now being made to put this important item into quantity production.

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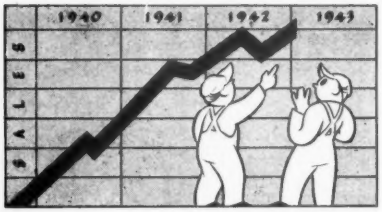

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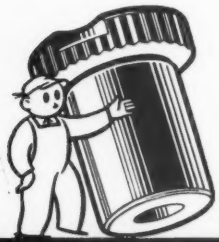

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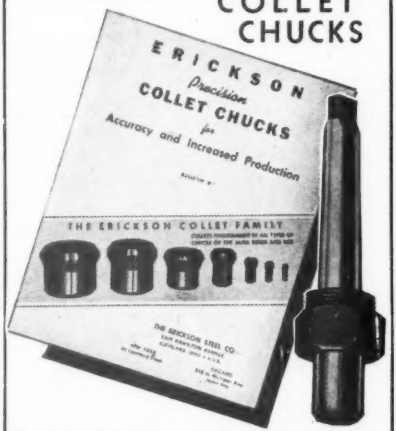

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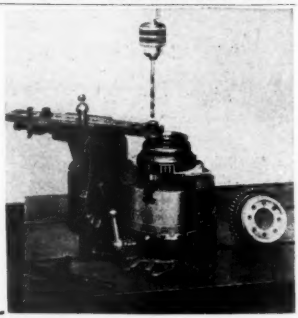

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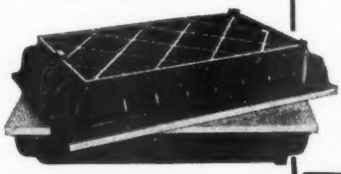

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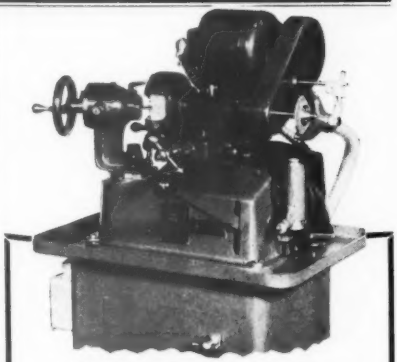

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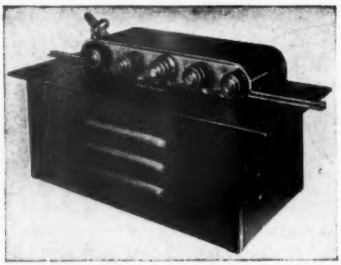

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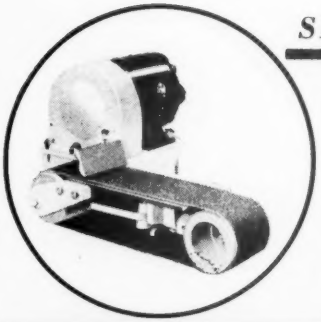

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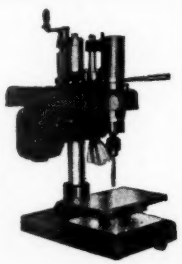

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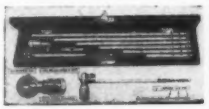

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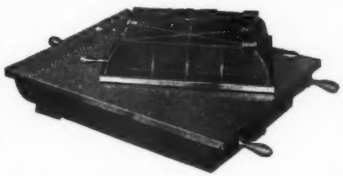

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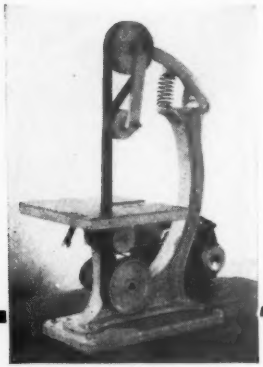

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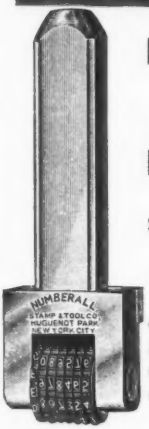

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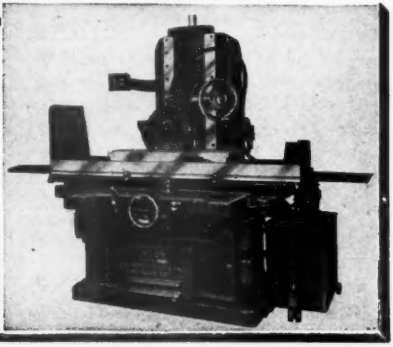

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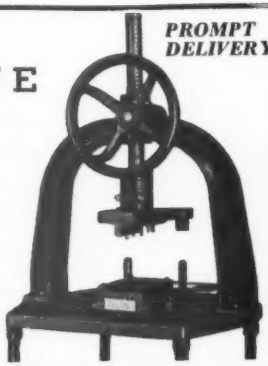

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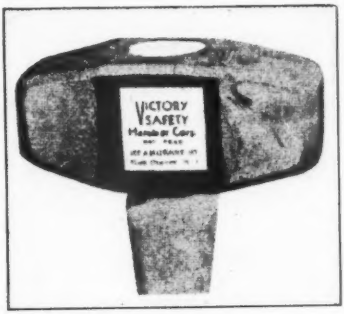

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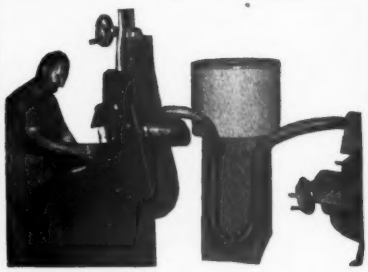

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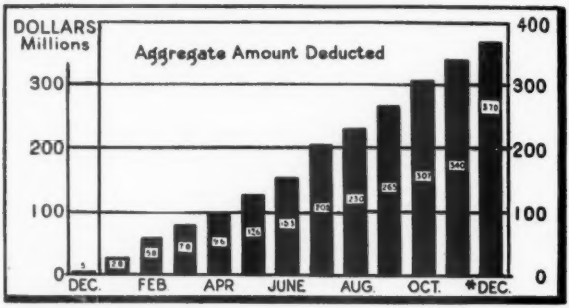

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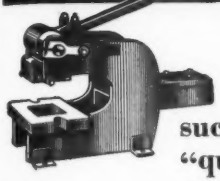

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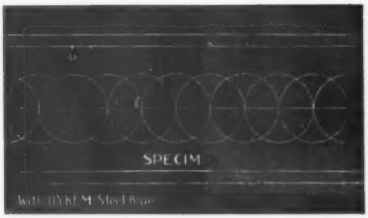

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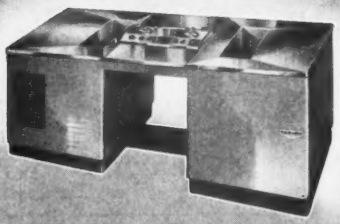

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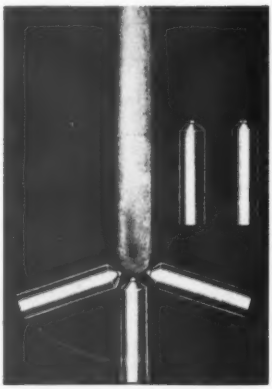

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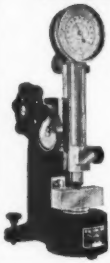

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(Continued from Page 215)

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(Continued from Page 81)

weight to insure return when the punch ascended. Prior to drawing, the shell was annealed at 500° F for 5 minutes. As an experiment it was decided to draw the shell without the inside blank holder. With nothing changed other than the removal of this member the shell was redrawn and checked. It contained many deep wrinkles on all 4 sides which would have necessitated considerable ironing to remove in the final operation; and while this could be accomplished, many disadvantages prevail to make it impractical to draw shells in this manner. Among these are: excessive cold working and undue strain, more wear on the dies, a higher annealing temperature requirement with closer control, and a shell the appearance of which was not entirely satisfactory even after ironing in the final operation. The experiment was made in order to illustrate the importance of properly supporting the metal during redrawing, especially where the redraw is in excess of 10%. The corner radius in the die was .281 and the drawing radius .125. A check-up of the shell thickness revealed further thinning and thickening — along the lower end .023 at the corner, and .020 at the side. The clearance provided between punch and die was .032 at the walls and .037 at the corners.

The final or third redrawing operation also called for a die of the "push through type" and consisted essentially of a punch and die operated in a single action press. No inside blank holder was employed in view of the small reduction. Before discussing further details of design it might be well to start with the tryout to illustrate conditions which are apt to be encountered in development of tools of this character. Shells made during tryout showed burnished corners running the full length of the shell. This burnished surface extended approximately ⅛ to ¼ beyond the 90 degrees of the corner radius. At the sides the surface appeared pitted and porous and seemed on the verge of fracture. In fact, some of the shells made were fractured at the sides. On the basis of these results it was apparent that excessive ironing was taking place at the corners where the metal had thickened considerably. The stress at these points was more than the sides could withstand. By

(Continued on Page 219)

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FAST! POWERFUL!
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Complete with Foot Control Valve, Air Hose and Fittings

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— even by green hands . . .

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PEDESTAL MICROMETER
formerly called Bartelt Tool Setting Gage

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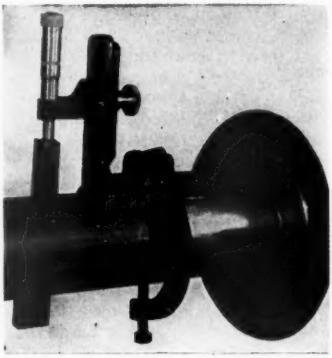

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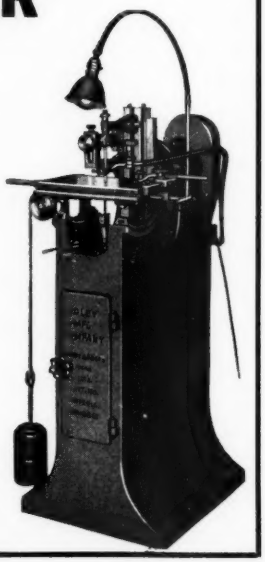

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FOLEY MFG. CO. 4 Second Street N. E., Minneapolis, Minn.

Manufacturers of FOLEY Automatic Saw Filers, Grinders, etc.

(Continued from Page 217)

removing approximately .001″ from the punch at the points indicated by the burnish marks on the shell, the trouble was completely eliminated, although a slight ironing action was retained; that is, the clearance between punch and die was approximately .003″ less than the wall thickness of the preceding shell, taken as an average. The drawing radius of the die is shown in Fig. 6.

Blank Development of Deep Drawn Rectangular Shell

The development of blanks for deep drawn rectangular shells by theoretical means is practically impossible. A brief analysis will indicate the reasons. In round drawn shells the problem is comparatively simple in view of the fact that stresses, both tensile and compressive, are uniformly distributed about the center. In rectangular drawn shells the problem is far more complicated. The combined bending and drawing, the distribution of surplus metal from the corner area into the adjacent side wall area, and ironing, are factors which serve to affect the final outcome. In order to achieve a fairly uniform shell after the final drawing operation, it is necessary to provide material in the blank where it is required. For example, too little material in the blank at points which become corners will result in short uneven shells. Too much material will result in increased tensile stress in the wall and may cause the bottom to break out. Therefore, it will readily be seen that the problem will have to be solved on the basis of practical consideration. The following is an effective practical method used in developing blanks for a number of rectangular deep drawn jobs.

To illustrate the method, the steps in determining the blank contour for a copper shell of dimensions shown in Fig. 1 will be followed through.

Although it is known that the developed blank will finally take some irregular form, the basis of the development will be a round blank, the area of which will be equivalent to the total area of the final rectangular shell. The area is found to be approximately

1.138″ × 3.972″ × 2	=	9.040″
1.638″ × 3.972″ × 2	=	13.012″
1.138″ × 1.638″	=	1.864″
		23.916″

(Continued on Page 221)

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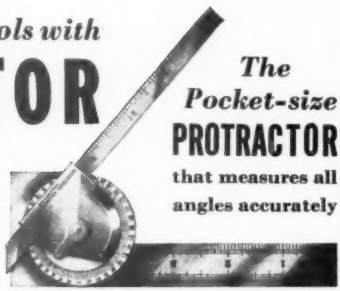

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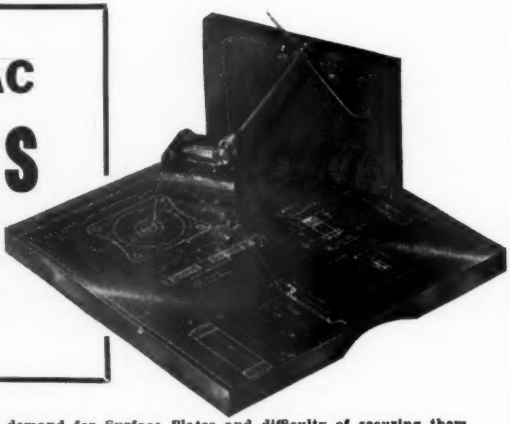

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(Continued from Page 219)

Diameter of a circle with equivalent area is 5.516".

Before proceeding with the method of layout, it might be well to state that the above calculations are based on the final trimmed shell with no allowance for trimming. Material for trimming was obtained by a slight ironing action in the final redrawing operation. This was approximately .002" to .003" on a side and provided $\frac{1}{8}$" to $\frac{3}{8}$" of stock for trimming. This method is economical where permissible.

Continuing with the blank development, the first step consists of laying out accurately to scale a cross-section of the final shell as shown in the layout. (Fig. 7.) Diagonal lines A-A and B-B are drawn through the shell section, and the trial blank diameter (Fig. 7, detail A) is laid out and points c-c and d-d are marked off. These points will be the upper corners of the final shell. A series of equally spaced construction circles are laid out starting outside of the shell cross-section. These are intersected by an equal number of elements and both are numbered as indicated. The purpose of numbering the construction lines is to provide means of identifying the points at which metal is to be added or removed. After a layout has been made on paper for record purposes, a similar layout is made on the stock to be used. Layout fluid should be applied and all construction lines and figures deeply scribed in to permit identification after drawing. This circular blank is then cut out and used as a template in laying out additional blanks on which only the horizontal and vertical center lines are scribed in. Having prepared several blanks in this manner, half the blanks are run through the 1st draw operation and the others through the 2nd, 3rd and final operation. The reason for this procedure lies in the fact that rather than endeavoring to arrive at the answer directly from the last draw, it is much easier to determine from the 1st draw shell where stock should be added or removed by checking with the final draw. If the 1st operation shells appear to be consistently similar, the template with all the construction lines and symbols is drawn into a first operation shell and used as a guide for determining the required blank contour.

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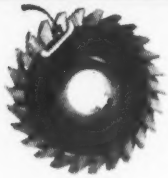

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Castolin Eutectic Low Temperature Welding Alloys are the original low temperature alloys that are revolutionizing production welding, maintenance welding and salvaging in war plants throughout the nation. There are 42 specialized rods for every metal and every welding job . . . the widest range in the U. S. A. Whatever your welding problem — present it to Castolin Eutectic first!

Complete procedure for salvaging these and other war production tools contained in special wall poster. Sent free. Write Dep't U.

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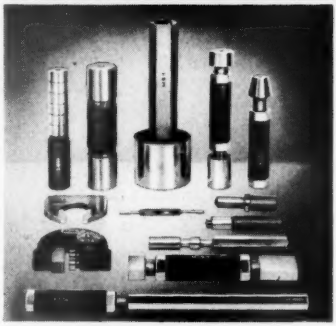

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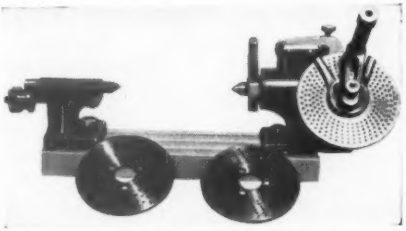
QUOTATIONS AND LITERATURE ON REQUEST

New Dividing Head Ready for Use

NEWEST dividing head to be manufactured by Jefferson Machine Tool Co. is a 7½" swivel base model (illustrated).



Complete information is available from Jefferson Machine Tool Co., 710 N. Fourth St., Cincinnati, O.

It has an index center with capacity for 7½" diameter work and adjustable tailstock with clamp lock for center. Its spindle is hardened and ground with 2⅜"—6 threaded nose. The index is operated by means of worm and worm gear with a 40:1 ratio. Index plates are furnished to provide divisions from 1 to 50; even division from 50 to 100, plus 55, 65, 75, 85 and 95. All other divisions to 360 are shown on the index table. It has a direct index plate for 2, 3, 4, 6, 8, 12 and 24 divisions.

Two other new products, also included in Jefferson's latest catalog, are the improved Jefferson Precision Milling Machine (Hand Feed) and the new Bull-Dog Precision Milling Machine (Power Feed).

The hand power model has a ⅓ hp., 1750 rpm motor which operates on high-torque, single-phase, 60 cycle, 110 or 220 volts A.C. power. Also available are a 3-phase, 60-cycle motor, 110 or 220 volts and a 3-phase, 60-cycle motor, 440 or 550 volts. Included as standard equipment are a draw-in attachment, ½" collet, ⅓" hp motor, drum-type forward and reverse control.

The power feed "Bulldog" model has a spindle mounted in tapered Timken roller bearings with four speeds—200, 400, 700, 1000 rpm.

Convenient! ... Saves Valuable Time!

TOOL MAKER'S BENCH LAP SET

SEVEN of the sizes most commonly used in tool and die work are selected in making up this Bench Lap Set.

Complete Set consists of one lap each of the following sizes: 1/8"-3/16"-1/4"-5/16"-3/8"-7/16"-1/2"; convenient die cast Base; one 6-ounce can of Copper Head Lapping Compound.

Shipped From Stock

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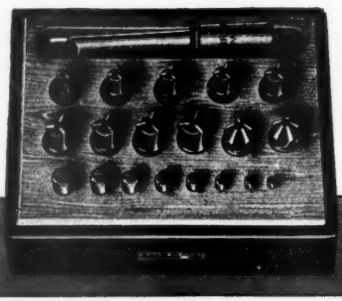
COUNTERBORE SETS

Today's war production program demands accurate, efficient cutting tools *within easy reach.* Gairing standard kits provide the answer for counterboring and spotfacing operations. Seven sets from which to choose. Each contains a logical assortment of *interchangeable* counterbores, pilots and holders boxed in sturdy cases.

THE GAIRING TOOL CO., Detroit, Michigan

For a quarter century specialists in fine cutting tools.

The set illustrated here consists of one Type A-1 holder, 9 cutters ranging from 1/4" to 1/2", 8 pilots from 5/32" to 3/8", 2 countersinks 1/2" dia., 70° and 82°. *Write for catalog and prices.*



Gairing TOOLS

(Continued from Page 96)

ficiency of even a 14 percent tungsten steel has to be sacrificed under the prevailing conditions to give the added toughness required.

Hardness figures taken recently on a large number of high quality 18 percent tungsten high speed steel twist drills showed that in only one instance was the hardness of the drill equivalent to what would be expected from an 18 percent tungsten high speed steel lathe tool. In most instances, the diamond Brinell number was much below normal.

This means that in each instance the manufacturers had made the drills as hard as they dared, consistently with the necessary toughness required to meet the prevailing conditions in engineering shops. Thus, the cutting efficiency of which even a medium quality high speed steel is capable had been partly sacrificed.

Maximum Cutting Efficiency Necessary

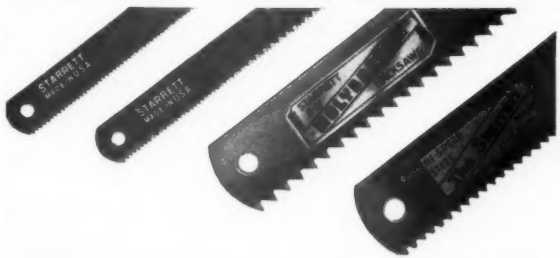
Obviously, therefore, the harder super-high-speed steels cannot be successfully used unless means can be found to use them fully hardened so as to give their maximum cutting efficiency. This means that design must be modified.

Between the drilling of boiler or ships' plates and that of manganese steel lies a vast field, beginning with a demand for specially tough (softer) drills, and ending with a demand for the hardest and best. But the gradation from one extreme towards the other entails a change of design as important as the change in quality and hardness. The altered design consists of an increase in the rigidity and strength of the drill, incorporating at the same time the best helix angles, web-thickness, flute width, and so on for the nature of the work.

Standard twist drills in Britain are invariably made to the British Engineering Standards Association Specification No. 328/1938, but when a user desires to penetrate an unusual thickness of material he does not hesitate to order a drill specially long on the flutes to

(Continued on Page 227)

THE *"MAKE"* OF HACKSAW IS DOUBLY IMPORTANT *NOW!*



If you must have fast cutting, long lasting blades right along and no fooling, stick to blades that carry the name STARRETT.

***STARRETT makes the right blade for the job*—Standard Steel for hand sawing, S-M Molybdenum for fast cutting and long life on both power and hand work, High Speed Steel for power sawing of extra hard alloy steels.**

Ask your mill supply distributor for STARRETT Hacksaws.

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WHERE THE GOING IS TOUGH!

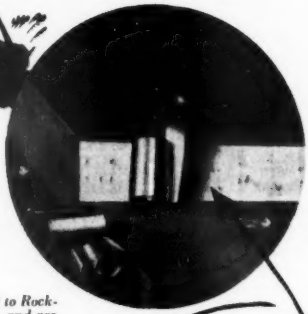
ON THE BATTLE FRONT OR IN THE SHOP—

EFFICIENCY COUNTS...

That's why

Tru-Cut TOOLS

WIN IN THE BATTLE OF PRODUCTION



Actual photo of Tru-Cut Gold Tip Bit. 11/16" cut, .020 Feed, 1020 SAE Steel.

Use Gold Tip and Blue Nose Bits on tough jobs like this and watch results.

Specially treated to Rockwell "C" 62-65, and are not brittle.

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TRINDL PRODUCTS, LTD.

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(Continued from Page 225)

suit his requirements. It was seldom that the user thought of specifying drills *shorter* on flutes than standard. There was, and in some directions still is, a definite prejudice against shortening drills, although in many difficult drilling operations they are now known to overcome the greater part of the difficulty.

Quicker and Better Drilling

The sole object of shortening the drill flute length is to enable it to drill quicker and better, and to do more work. Two instances may be given where standard length and ordinary quality high speed steel twist drills were altered and achieved satisfactory results.

In one shop, thousands of 9 mm holes had to be drilled in austenitic chromium nickel stainless steel plates. These plates were exceptionally large, so that the job had to be carried out under a line of plate drilling machines, with the finest feed, one hundred cuts per inch penetration. New drills of orthodox design were used, but trouble quickly followed. A cure was effected by simply shortening the flutes.

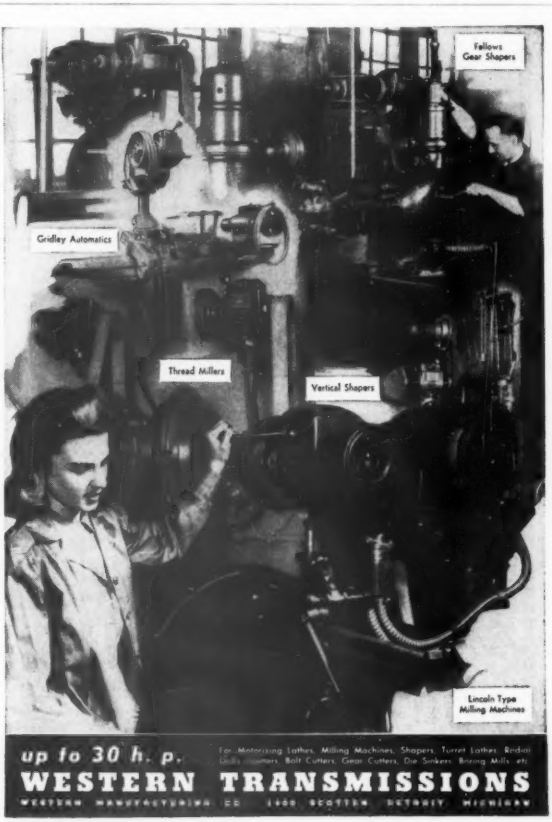
Before this modification, the margin of strength and safety was small, resulting in chatter or breakage following the loss of the keen cutting edge. This resulted in a high percentage of broken drills, and a large number of blind holes needing special attention.

Safety Enormously Increased

The average performance was about twelve holes per grind. When the drill flute length was shortened, the margin of safety was enormously increased, and actually resulted in eliminating all broken drills and blind holes, the average number of holes being raised to over one hundred per grind. Thus, the cost of the job was greatly reduced and production improved.

In another instance, far more than the normal amount of breakages occurred in drilling $\frac{1}{2}$" holes in castings for the attachment of machine nameplates. A shortened drill was supplied $\frac{1}{2}$" dia. by 1" long on flutes, $2\frac{3}{8}$" overall, with a web thickness much greater than standard, thus making the drills considerably more robust. This per-

(Continued on Page 229)



Wrenching and adjusting chucks waste production time

BARKER
Wrenchless
CHUCKS

keep your lathes working—not waiting.

Now the usual chucking time can be used for actual production.

BARKER Wrenchless Chucks can be adapted to any type of work that may be done on turrets, engine lathes, semi-automatic or pipe threading and cutting-off machines.

The BARKER Wrenchless Chuck is simple and sturdy in construction. It is compact—requires no accessories to install. It permits bar work to spindle capacity. A quick movement of the lever releases or grips the work. Well adapted for a diversified line, from small brass castings to heavy forgings. Write TODAY for full details.

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Free Re-Grinding Offer

POINTING out the importance of using existing files, Superior Salvage Co., 4917 Barkwill Ave., Cleveland, O., has offered to regrind free one file, rotary or flat, of any reader. This trial offer is made to acquaint file users with the quality of this firm's work and its usefulness at a time when conserving steel, time, and labor is so important.

Re-use of files through their regrinding, as often as several dozen times, has changed the attitude of metal and plastics manufacturers toward rotary files, allowing them to use their files—longer.

Superior Salvage Co., a new file salvage firm just recently organized promises 48-hour service. It suggests readers try this free file grinding offer and see for themselves how effective a conservation method it can be.

(Continued from Page 227)
formed the work without any breakages whatsoever.

Similar examples could be multiplied indefinitely, but I will only give one more. Oil holes were drilled in rustless steel bars, the holes being about 6" deep by $\frac{5}{16}$" diameter. Ordinary 14 percent tungsten high speed steel twist drills were used, but failure through breakages was continually experienced.

Problem Solved by Shortening

The problem was again solved by using a drill with a flute length of 2½", the remainder being plain cylindrical material. Frequent withdrawal of the drill to clear the chips was carried out, and a super-high-speed steel drill employed, of a special design. The drill was successfully used in drilling high carbon steel samples, and measured 1" dia. x 4½" flute length, by 9⅛" overall.

The most difficult of all materials to drill, manganese steel, has surrendered to commercial drilling by specially designed twist drills of super-high-speed steel, but only because the drills were designed for the job. Hence, Britain's engineers are not only shortening their standard drill flute lengths to meet the requirements of difficult jobs, but are concentrating more and more on special designs of twist drills for specific jobs and materials.

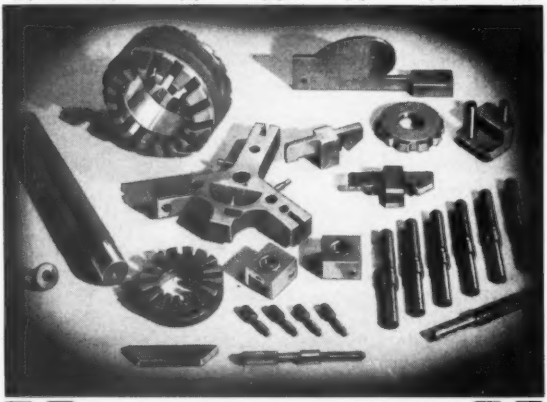
More "E" Awards

"For more than ordinary effort" two more firms have been awarded the coveted Army-Navy "E".

The Delta Mfg. Co. of Milwaukee, Wis., received this joint honor at ceremonies January 15 and the Baker Brothers, Inc., of Toledo, Ohio, joined the roll of "E" industries, March 20.

At the later ceremony, Baker Brother workers laid credit for their success to a labor-management liaison plus 75 years of "know-how." Two employees of 44 and 42 years service respectively were among those given "E" lapel pins. Representing the Army was Lt. Col. Geo. W. Hibbert and the Navy—Com. F. J. McManamon as Pres. Geo. E. Hallenbeck accepted the award for the company.

★ ★ ★ ★ ★ ★ ★



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War Winning Production Tips

Offered to Speed Victory

A CUTTING tool production program which has proved invaluable in manufacture of many types of armament was announced today by E. F. Fisher, general manager of the Fisher Body Division of General Motors.

The project was instituted at a Ternstedt Manufacturing Division plant (Fig. 1) when it became apparent that slow delivery of vital cutting tools might delay Fisher Body's tank, anti-aircraft gun, naval gun, bomber, aircraft instrument, and other projects.

As a result of this special program, Fisher disclosed, some cutting tools which could not have been obtained for 15 weeks were built in a week or less. The program was started principally to assist in production on M-4 tanks, but subsequently it was expanded to give assistance to various other armament jobs in Fisher Body, and then to other divisions of General Motors.

At present more than 750 different kinds of cutting tools are being manufactured, and since its inception the plant has turned out a total of more than 50,000.

Cutting tools play an unheralded role in mass production of virtually all types of war goods. They are the bits, drills, reamers, teeth and similar cutters which are used on a multitude of different types of machines. Without them, volume production on a project such as tanks would be almost impossible. Fisher explained this program was inaugurated to avoid a threat of retarded production because of necessarily slow delivery due to the demand upon cutting tool manufacturers as a result of the nation's mammoth war production program that far exceeded the industry's capacity.

SUGGESTIONS from workers on the Production Front have frequently proved invaluable aids in increasing output. In place of the "Buy With Confidence" section, regularly appearing in this space, The TOOL & DIE Journal presents this month a series of workable adaptations to war shortages and demands for the benefit of its readers.

Fisher reported that although manufacture of cutting tools is as foreign to automotive building as is production of tanks or guns, nevertheless the plant can now turn out up to 500 tools a day. He also pointed out that nearly all the tools are built on special order to meet specific requirements, rather than on a mass production basis of standardized types. Those now being turned out range in weight from ¼ of a pound to 100 pounds, and quantities of different types range from a single tool to several hundred.

Numerous developments have been achieved on this job in methods of making such tools. An outstanding example is improvement of the use of tool holders—a method whereby the cutting unit consists of a holder and the tool itself. When the tool breaks or becomes dull, a new one can be inserted in the holder, eliminating replacement of the entire unit.

Fisher revealed that development of this idea for cutting tools to be used in connection with tank ring and turret turning operations had resulted in a monthly saving of 30,000 pounds of critical steel on this one operation alone.

Fig. 1

Expressed in a different way, this means that whereas the entire unit might consist of 100 pounds of steel, the actual cutting unit itself might weigh only six pounds. Thus each time a new tool became necessary, only six pounds would need to be replaced instead of 100.

The plant also has devised a means of salvaging cutting tips on small tools. Such tips are usually small pieces of high-grade carbide fastened to the end of the unit. When the tips become worn or broken they are removed by an acid process, reworked and resharpened, then reinserted in the holder. Officials believe this was the first time a means had ever been developed of successfully salvaging such tips.

As another outstanding development, the plant has devised what is known as a tapping arbor with interchangeable cutters. The arbor is, in effect, a holder into which a series of cutters are set. They must be so exact that cutters made for one arbor, or holder, heretofore could not be used in another holder.

Fisher Body now makes the arbors on a volume basis with all cutters interchangeable in any arbor.

Welding Equipment Converted For Incandescent Brazing

AMONG the special-purpose machines converted from peace to war production at General Electric's Schenectady Works are some spot welders and line welding machines previously used for refrigerator unit manufacture and now used for incandescent brazing.

The spot welders were adapted for incandescent brazing by the following three changes:

1. A switch was installed in the controller box to provide the con-

Fig. 2

tinuous flow of power necessary without the use of the drive motor.

2. The standard spot-welding electrodes were replaced by dummy copper electrodes drilled and tapped at one end where copper blocks are attached for the water-cooling supply and return.
3. To these copper blocks were attached large water-cooled leads (183,000 circular mils) and brazing tongs.

The leads were made 10 feet in length so that the working area would not be limited to the table. Figure 2 shows the table set up with blocks to braze a Y-shaped lead to a flat strip of copper. Plier-type brazing tongs can be connected to these leads and brazing operations performed within a 10-foot radius of the table. This permits other jobs to be set up while working on one.

The transformers were removed from the line-welding machines, providing immediately an adequate supply of that equipment for permanent installation elsewhere as needed. These spot- and line-welding transformers have a range of from 75 to 250 kva in capacity operating on 550 volts a-c primary and 4 to 14 volts secondary, having a range of from 0 to 16 points of heat. This extra range in secondary voltage permitted the use of longer leads than would be possible with the 10- and 20-kva brazing transformers ordinarily used, and were ideal for that reason. They are water cooled, minimizing the possibility of burnouts from overloading.

Foot Control New Safety Measure in Rotary Welding

ACTING on the suggestion of a jig and fixture department employe, Fisher Body Division of General Motors has developed a foot control for a rotary welding fixture (Fig. 3).

The device enables the welder to control by foot all mechanism that was formerly controlled by push buttons. In the latter operation, the welder had to lift his shield in order to stop the rotary device.

The suggestion, made by William Bolton, enables the welder to hold his shield with one hand and the electrode holder with the other, and at the same time maintain with a foot lever better control of all mechanism.

Fig. 3

Tank Power Trains Manufactured

MANUFACTURE of power trains for medium tanks is an operation of bulk and precision requiring the machining and assembly of units weighing in the aggregate of several thousands of pounds but at the same time demanding precision not ordinarily associated with equipment of this size.

To accomplish output of these huge assemblies required extra rugged machine facilities, convenient methods of handling the heavy work, and advanced fixture development permitting holding of the pieces simply, yet firmly and entirely accurately as the heavy work progresses through the machining and assembly operation.

These conditions have been satisfied to a notable degree and operations in the plants have evolved from a makeshift stage, utilized at the beginning of production and necessitated by a hurried start, to a point where work now flows smoothly from machine to machine, with each station fitted for an individual job which often consists of multiple operations.

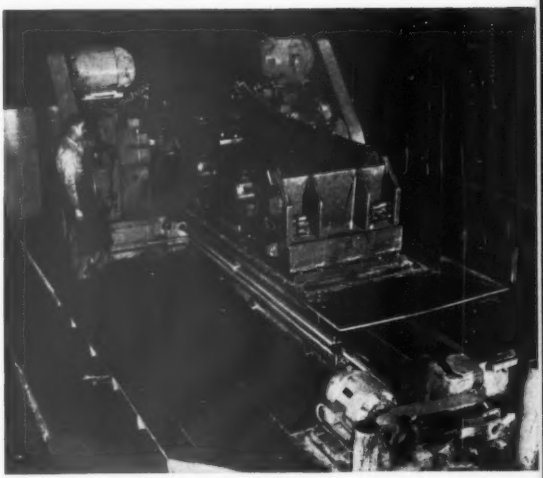


Fig. 4 (Above) — Fig. 5 (Below)

This evolution involved the design and construction of some of the largest special purpose machines in use in the automotive industry's war production and the application wherever possible of multiple operations on single machines in order to reduce manufacturing time and conserve space as an absolutely necessary element in attaining volume production.

Notwithstanding the specialized charter of the work, approximately one fourth of the machines required in the current volume of output were converted from former automotive uses and the present manufacturing processes were developed from an initial temporary production layout involving slow and laborious operations with makeshift equipment that was discarded as rapidly as new was designed and placed in operation.

In Fig. 4 showing the installation in a medium tank, the completed final drive and transmission unit has been fully tested and inspected and is ready for shipment to the tank assembly plant. They are leaving the assembly lines like clockwork, according to Buick, and in volume that represents a censorable high rate.

In the evolution to volume production methods and equipment, a number of outstanding shortcuts were accomplished

Fig. 6

through the use of specialized machines. Fig. 5 shows one of the most complicated jobs in the entire process. Here three huge housings are fed at one time through a special milling machine which roughs and finishes the end faces in one operation. This machine operates over a 36-foot bed and the fixture for the operation weighs almost seven tons.

Final assembly of the power train starts with the installation of gears in the transmission cases. Meanwhile, the final drive assembly is being joined together and gears are installed in the carrier. After this installation, the transmission case assembly is united with the final drive assembly and the whole unit is assembled into the differential housing.

Following final assembly, the entire power train proceeds to the test stand and to the paint booth. After painting, the sprockets and hub are attached, and shipment to the tank plant takes place.

Rapid increase in volume from the beginning of production has marked this phase of Buick's war manufacture, according to company officials, with final drive units leaving the assembly line in maximum scheduled quantities for a number of months.

Throughout the processing of the unit, substantial re-design was effected to improve the function of the power train, particularly with respect to the synchronizing assembly in the transmission, lubrication and material specification, with the result that the unit has an exceptionally high performance rating in the tank service.

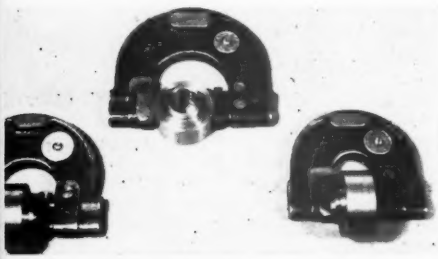


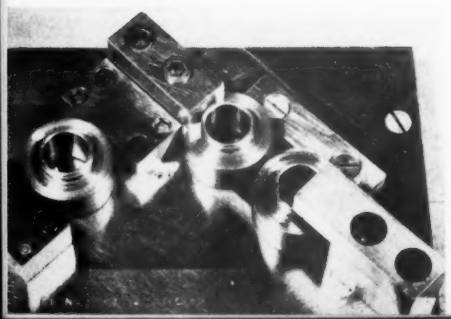
Fig. 7A
Fig. 7B

New Bit Retainer Inexpensive

A BIT retainer for inserting bits to be used in assembly of the hull of a tank, as suggested by an employe in final assembly at the Grand Rapids tank plant of the Fisher Body Division of General Motors, has resulted in savings of several hundred dollars (Fig. 6).

New blades and holders are in one piece and previous to the adoption of this suggestion the entire piece was discarded when the blade was broken. The suggestion to make the retainer and the bit separate was found to be a good one and was placed into use.

A slot is machined in the old socket, together with two holes. Bits made from scrap weld are inserted in the holder by means of a pin. Cost of the bit retainer has been reduced about $2.50 each, as a result of the suggestion.



3-Way Gage Boosts Inspection Rate 85%

A THREE-IN-ONE gage that has eliminated handling of three separate gages for inspection work on bearing cups has been designed at Fisher Body's

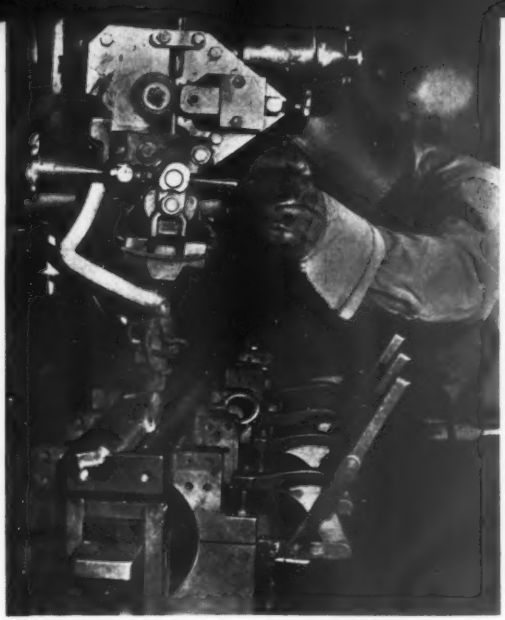


Fig. 8

Ternstedt Manufacturing plant as result of the suggestion of a woman inspector. The photos show the old type gages (Fig. 7A) and the new three-way device (Fig. 7B) which increased production on this operation 85 percent.

Welding Time Reduced With New Welder

AUTOMATIC arc welding has resulted in reducing the time for welding collector ring tail pipes from 25 minutes to two minutes at the GM Fleetwood unit. The welding machine (Fig. 8) was built by Fleetwood engineers who state the weld is far superior to a hand welded job and requires little or no repair.

Backup Bar Eliminates Root Bead Cracking

CRACKING of the root bead in the welding of vertical seams has been eliminated at the GM Ternstedt Manufacturing plant by the adoption of a convex backup bar as shown in Fig. 9.

A DIRECTORY of products, listing for ready reference the names of manufacturers and dealers whose sales to The TOOL & DIE Journal readers have established them as dependable in every sense of the word, is now available to readers upon request. Regularly appearing in this space, this directory is now printed in convenient leaflet form.

Sizing Reamer for Restricted Locations

A REPETITIVE production tool devised by Henry Bernadt, a methods man at General Electric's Schenectady Works, quickly and accurately reams holes in restricted places that are difficult to reach with scrapers. The tool is essentially an expansion reamer and

Fig. 9

Fig. 10 shows the unit set up for operation.

When set up for production, the unit is first disassembled, an operation that reduces the diameter by about .002". The reamer (A) is inserted in the hole to be finished, and tightened against a washer (B) by a twist of the arbor (C). This expands the tool to the proper diameter and reams the hole to the correct tolerance in one turn. Part "D" is a guide member.

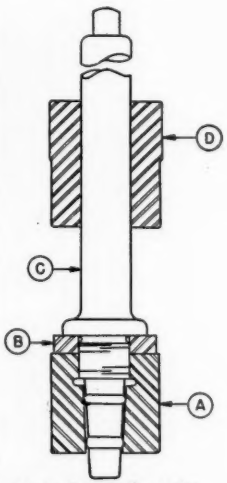
Cutter wear is taken care of by decreasing the thickness of the washer. This permits the taper portion of the arbor to further enter the cutter. A .001" reduction of the washer thickness will expand the reamer .0001".

Three-In-One Gage

WOMEN are playing an increasingly important part in the nation's war production and, in addition, are coming in for their share of suggestions to improve manufacturing processes. An example of an unusually productive suggestion, one that resulted in an 85 percent improvement in operation, is the suggestion made by Mrs. Helen Bering, a special detail inspector at the Ternstedt Manufacturing plant of Fisher Body.

Mrs. Bering suggested a three-in-one gage for use in inspecting a bearing cup. Before the suggestion, three dimensions on the cup were gaged, one snap gage being used for each dimension. This necessitated handling either the snap gages of the part three times during the inspection cycle.

Mrs. Bering recommended that the gage be fastened permanently to a plate,

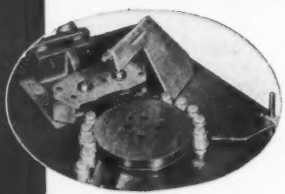


Sizing Reamer For Holes In Restricted Locations

Fig. 10

FUSE MARKING
with Matthews No. 201 Machine

All required data is marked on fuse bodies, fuse parts, or other round pieces with this fast production machine. Practically all sizes and models of fuses can be marked.



The insert, above, shows a close-up of how fuse parts are marked. Parts are carried around on the pressure dial table and are quickly and legibly marked when rotated between dial and steel type holder. Write for literature.

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thus eliminating holding of the gage or part during the inspection operation.

Under the old method 290 pieces could be checked in an hour, while with the new gage it is possible to check 538 pieces an hour.

Expansion Dies Increase Parts Production

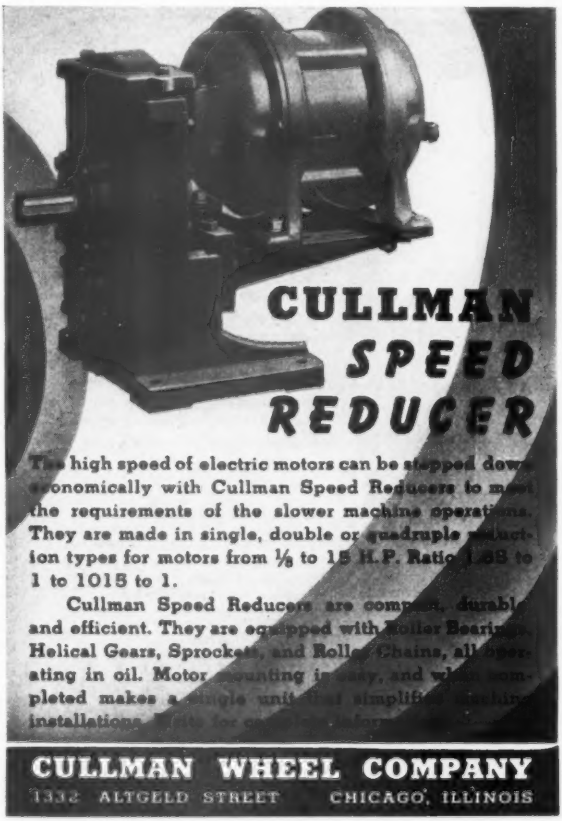
EXPANSION dies shown in Fig. 11 have helped the Fleetwood unit increase its production of vital parts for the nation's big bombers. A hand operated expansion die took ten minutes to complete a ring on one end of a manifold. This machine, which was formerly a punch press, can do two a minute.

Fig. 11

SUGGESTED by a maintenance department employee, a lubri-spray gun that enables a machine oiler to more conveniently lubricate press gears has found a four-fold purpose at the Detroit Stamping Unit of Fisher Body.

Such a device could be built by other plants where gears of large presses must be lubricated constantly, plant officials said. Primary object of the grease container is the saving of time, and it is so constructed that the oiler can carry it over his shoulder by a sling, enabling him to climb a ladder instead of waiting for a crane to lift his greasing equipment up to him in order to reach the gears.

The lubricating gun is made of two 3-quart light metal grease containers, fitted with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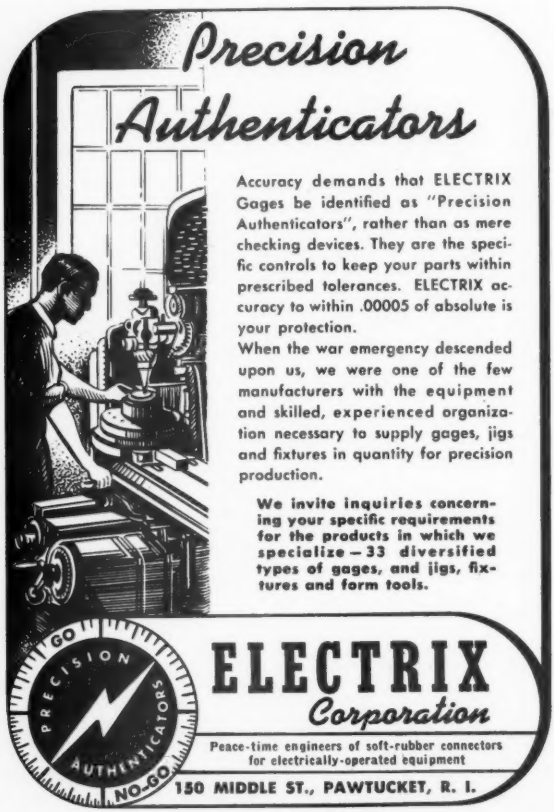
easily fastened and removable lids. The center of each lid should have a ⅜" pipe thread opening for a like-size pipe bushing. The bottom of the containers should have a ¾" pipe thread opening for a similar size bushing. A metal follower is used to follow grease through the container. Gun nozzles and air control fittings can be arranged from plant supplies.

Plant officials said the adoption of the suggestion, made by Elmer H. Isaacks, has led to increased efficiency, more convenience for the oiler, saving of time usually lost by machine oilers waiting for die and production men to release a crane and also the saving of time usually lost by die and production men waiting for the oilers to release the crane.

WITH new workers moving into war production almost daily, the Fisher Body tank plant found it beneficial to publish a standardized set of hand signals for crane operations. Many new men, it was found, either were unfamiliar with crane work or had used signals differing from those prescribed in the tank plant. As a result, publication of the standardized signals brought about increased efficiency in crane work hazards.

The signals, with illustrations, were mimeographed and copies were given to all foremen, crane operators and hook up men. In addition to increasing efficiency, plant officials reported, a possible safety hazard has been eliminated.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We invite inquiries concerning your specific requirements for the products in which we specialize — 33 diversified types of gages, and jigs, fixtures and form tools.
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AS a precautionary measure to provide operators with safe access to a lower level in event of an unexpected power shutoff, all cranes at the Detroit Stamping Unit are now being equipped with rope ladders. The rope ladders were suggested by Harry Pomber, press room employe.

TO facilitate the moving of a large trailer from its loading docks without the aid of a tractor, a Detroit unit of Fisher Body has developed a new system.

A hole was burned in the platform of an electric shop truck equipped with a lift table. This hole is large enough to insert the pin on a trailer and move the latter to any desired location.

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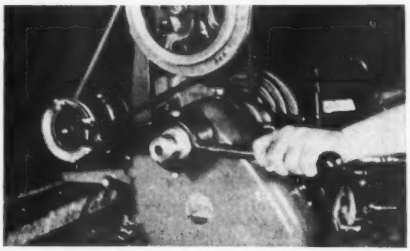

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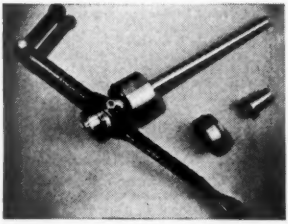

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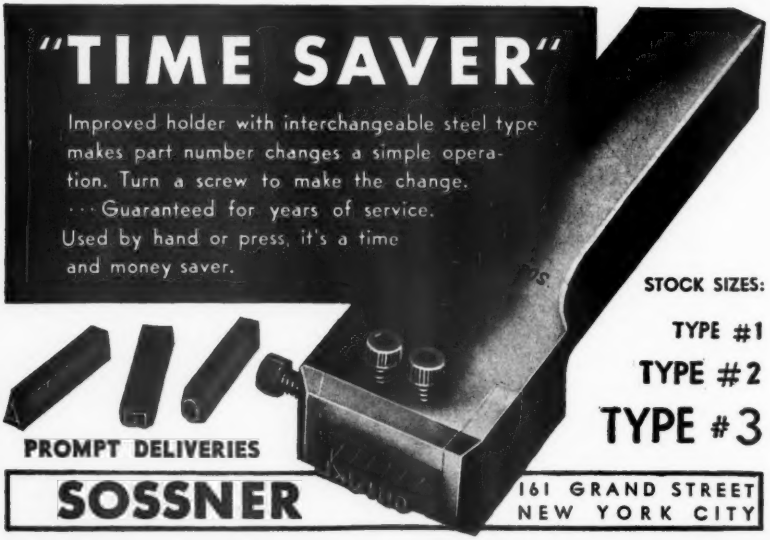

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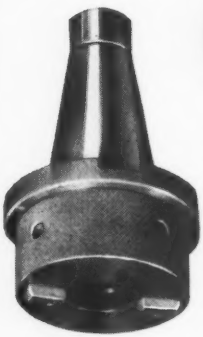

Master Unit Fits in Machine Spindle

Reduce Tool-Changing Time to 5 Seconds IN MILLING AND BORING . . !

With the Quick-Change Holder and interchangeable adaptors, tools in milling and boring operations can be changed in almost the twinkling of an eye. This is because, with the master unit installed in a machine spindle, any adaptor and tool assembly can be quickly attached, being locked in position by keys which are set or retracted by simply turning a collar on the master unit.

Once the tools for any particular job are fitted with adaptors, they can be interchanged in 5 seconds. On machines where frequent changing is necessary, the saving in time and labor will pay for the holder and adaptors in a few weeks' time. The adaptors are designed to take cutter arbors, end mills, face mills, side mills, boring cutters, drills, eccentric chucks, and other standard tools.

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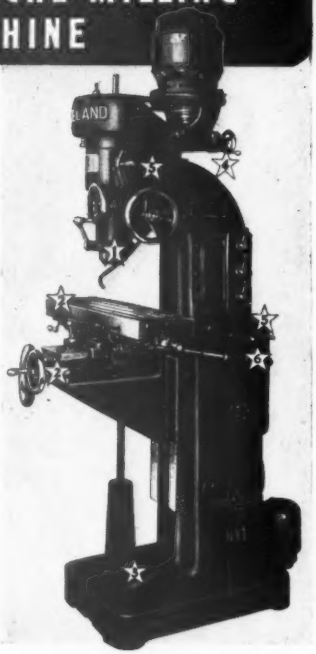
WELCOMED by war plants and wherever production *with accuracy* is of first importance, the Cleveland No. 1 Vertical Milling Machine has made good every promise. Features:

1. Big, husky spindle of chrome nickel steel heat-treated and mounted on 200-lb. preloaded precision bearings.
2. All lead screws and feed gears mounted on Timken bearings for smooth, quiet running and longer life.
3. Coolant sump in base. (Pump optional.)
4. Hand wheel and lead screw on spindle head for quick shifting of belts for changes of spindle speeds.
5. Also 3 speed changes on back gears, giving 12 speeds in all.
6. Feed box driven by ½ h.p. motor through V-belt with 3 speed changes on pulleys and 4 in gear box; 12 feeds in all to table.

Overload protection on all motors to prevent motor failure and resultant breaks in production. Longitudinal feed, 18"; cross travel, 8½"; vertical travel, 16". Table working surface, 8" x 32". Cutter capacity, $\frac{1}{16}$" to 2½" mills. Spindle speeds, 100 r. p. m. to 1800 r. p. m.

The Cleveland No. 1 is fast, powerful and rugged. It has amply satisfied the requirements of modern tool rooms, die and mold shops and production plants.



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